Prime Consulting Engineers Pty. Ltd.

Design Report:

6m, 8m, 9m, 10m & 12m X 3m Bay

Function Deluxe Tent Structures

For

80km/hr Wind speed

For

EXTREME MARQUEES

Ref: R-23-573-3

Date: 06/07/2023

Amendment: B – 18/03/2024

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1 Introduction and Scope:

The report and certification are the sole property of Prime Consulting Engineers Pty. Ltd.

Prime Consulting Engineers have been engaged by Extreme Marquees Pty. Ltd. to carry out a structural analysis of 12m X 12m Function Deluxe Tent Structure for 80km/hr. It should be noted that the outcome of our analysis is limited to the selected items as outlined in this report.

This report shall be read in conjunction with the documents listed in the references (Cl. 1.2)

1.1 Project Description

The report examines the effect of the peak gust wind that an equivalent moving average time of approximately 0.2S **22.22m/s (80 km/hr)** positioned for the worst effect on 12m x 12m tent structure as the worst-case scenario. The relevant Australian Standards AS1170.0:2002 General principles, AS1170.1:2002 Permanent, imposed, and other actions and AS1170.2:2021 Wind actions are used. The design check is in accordance with AS1664.1 Aluminium Structures.

1.2 References

- The documents referred to in this report are as follows:
  - Report on results produced through SAP2000 V24 software & excel spreadsheets.
- The basic standards used in this report are as follows:
  - AS 1170.0:2002 – Structural Design Actions (Part 0: General principles)
  - AS 1170.1:2002 – Structural Design Actions (Part 1: Permanent, imposed, and other actions)
  - AS 1170.2:2021 – Structural Design Actions (Part 2: Wind Actions)
  - AS1664.1:1997 Aluminium Structures.
  - As 4100:1998 – Streel Structures.
- Section Properties of Aluminium Section provided by the client.
- The program(s) used for this analysis are as follows:
  - SAP2000 V24
  - Microsoft Excel

1.3 Notation

AS/NZS	Australian Standard/New Zealand Standard
FEM/FEA	Finite Element Method/Finite Element Analysis
SLS	Serviceability Limit State
ULS	Ultimate Limit State

2 Design Overview

2.1 Geometry Data

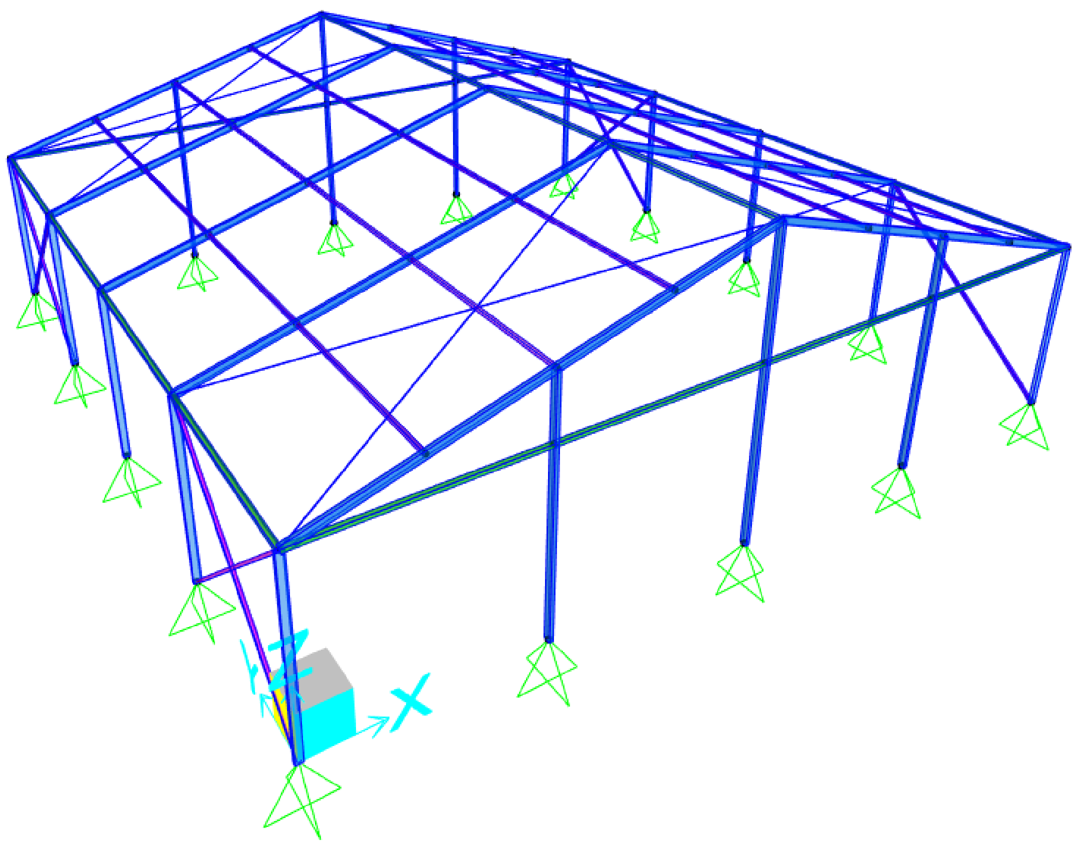

Figure 1 Isometric view of structures

2.2 Assumptions & Limitations

- The structure is for temporary use only and shall not remain erected for more than 6 months period.
- For forecast winds in excess of **80km/hr** all fabrics should be removed and the erected structure to be dismantled.
- The structure is design for wind parameters as below:
  - Wind Region A
  - TC2
  - M_s, M_t & M_d = 1
- It is assumed that the structure is fully enclosed with all walls equally permeable for calculating the wind internal forces.
- Shall the site conditions/wind parameters exceed prescribed design wind actions (refer to Cl.4), Prime Consulting Engineers Pty. Ltd. should be informed to determine appropriate wind classifications and amend computations accordingly.
- Wall X-bracing and roof cable bracing must be used at end bays and every third bay in between. This bracing configuration is shown in Figure 1 Isometric view of structures.
- Maximum Intermediate purlin spacing shall not exceed 1500mm for 40x40x2 purlin profiles.
- It is assumed that the fabric weighs 350gr/m^2.
- Aluminium alloy is to be 6061-T6.

2.3 Exclusions

- Design of fabric.
- Wind actions due to tropical or severe tropical cyclonic areas.
- Snow and ice loads.
- Footing design.

2.4 Design Parameters and Inputs

2.4.1 Load Cases

1.	G	Permanent actions (Dead load)
2.	Wu	Ultimate wind action (ULS)
3.	Ws	Serviceability wind action (SLS)

1.1.1 Load Combinations

Strength (ULS):

1.	1.35G	Permanent action only
2.	$0.9G+W_u$	Permanent and wind actions
3.	$1.2G+W_u$	Permanent and wind actions

Serviceability (SLS):

1.	$G+W_s$	Wind service actions

3 Specifications

3.1 Material Properties

Material Properties										
6061-T6	F_{tu}	F_{ty}	F_{cy}	F_{su}	F_{sy}	F_{bu}	F_{by}	E	k_t	k_c
	262	241	241	165	138	551	386	70000	1	1.12

3.2 Buckling Constants

TABLE 3.3(D) BUCKLING CONSTANTS FOR ALLOY 6061-T6						
Type of member and stress	**Intercept, MPa**		**Slope, MPa**		**Intersection**	
Compression in columns and beam flanges	B_c	271.04	D_c	1.69	C_c	65.89
Compression in flat plates	B_p	310.11	Dp	2.06	C_p	61.60
Compression in round tubes under axial end load	B_t	297.39	D_t	10.70	C_t	*
Compressive bending stress in rectangular bars	B_{br}	459.89	D_{br}	4.57	C_{br}	67.16
Compressive bending stress in round tubes	B_{tb}	653.34	D_{tb}	50.95	C_{tb}	78.23
Shear stress in flat plates	B_s	178.29	D_s	0.90	C_s	81.24
Ultimate strength of flat plates in compression	k_1	0.35	k_2	2.27		
Ultimate strength of flat plates in bending	k_1	0.5	k_2	2.04		

** C_t shall be determined using a plot of curves of limit state stress based on elastic and inelastic buckling or by trial and error solution*

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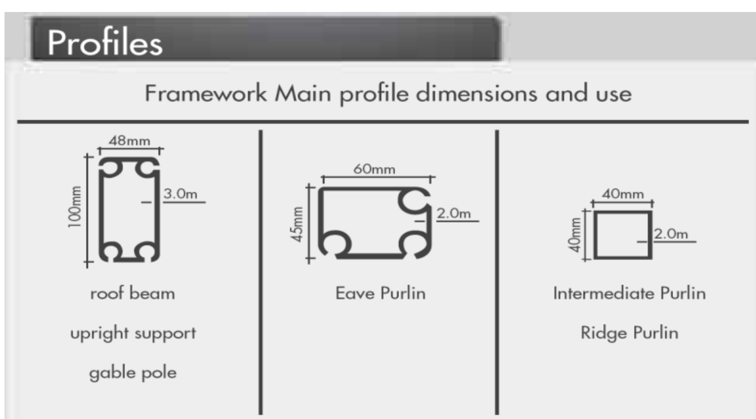
3.3 Member Sizes & Section Properties

MEMBER(S)	Section	b	d	t	y_c	A_g	Z_x	Z_y	S_x	S_y	I_x	I_y	J	r_x	r_y
		mm	*mm*	*mm*	*mm*	*mm^2*	*mm^3*	*mm^3*	*mm^3*	*mm^3*	*mm^4*	*mm^4*	*mm^4*	*mm*	*mm*
Rafter	100x48x3	48	100	3	50.0	852.0	21859.1	14218.5	27222.0	16146.0	1092956.0	341244.0	805065.8	35.8	20.0
Upright Support	100x48x3	48	100	3	50.0	852.0	21859.1	14218.5	27222.0	16146.0	1092956.0	341244.0	805065.8	35.8	20.0
Gable Pole	84x48x3	48	84	3	42.0	756.0	16902.0	12190.5	20790.0	13986.0	709884.0	292572.0	632667.9	30.6	19.7
Ridge & Eave Purlin	45x60x2	60	45	2	22.5	404.0	5955.3	6999.3	6841.0	8356.0	133993.7	209978.7	246338.1	18.2	22.8
Gable Beam	45x60x2	60	45	2	22.5	404.0	5955.3	6999.3	6841.0	8356.0	133993.7	209978.7	246338.1	18.2	22.8
Intermediate Purlin	40x40x2	40	40	2	20.0	304.0	3668.3	3668.3	4336.0	4336.0	73365.3	73365.3	109744.0	15.5	15.5
Brace	40x40x2	40	40	2	20.0	304.0	3668.3	3668.3	4336.0	4336.0	73365.3	73365.3	109744.0	15.5	15.5



4 Wind Analysis

4.1 Wind calculations

PRIME CONSULTING ENGINEERS PTY. LTD

Project: *Extreme Marquees*

Job no. *23-573-3* *Designer:* *AK*

Date: *6/07/2023* *Amendment:*

Name	*Symbol*	*Value*	*Unit*	*Notes*	*Ref.*
		General			
Importance level		2			*Table 3.1 - Table 3.2 (AS1170.0)*
Annual probability of exceedance		Temporary			*Table 3.3*
Regional gust wind speed		**80.00**	Km/hr		
Regional gust wind speed	V_R	22.22	m/s		
Wind Direction Multipliers	M_d	1			*Table 3.2 (AS1170.2)*
Terrain Category	TC	2			
Terrain Category Multiplier	$M_{Z,Cat}$	0.91			
Shield Multiplier	M_S	1			*4.3 (AS1170.2)*
Topographic Multiplier	M_t	1			*4.4 (AS1170.2)*
Site Wind Speed	$V_{Site,\beta}$	**20.22**	m/s	$V_{Site,\beta}=V_R*M_d*M_{z,cat}*M_S,M_t$	
Pitch	α	20	Deg		
Pitch	α	0.349	rad		
Width	B	12	m		
Width Span	S_w	3	m		
Length	D	12	m		
Height	Z	3.5	m		
Bay Span		3	m		
Purlin Spacing		1.5	m		
Number of Intermediate Purlin		6			
	h/d	0.29			

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	h/b	0.29			
Wind Pressure					
ρair	ρ	1.2	Kg/m^3		
dynamic response factor	C_{dyn}	1			
Wind Pressure	ρ*C_{fig}	**0.245**	Kg/m^2	$\rho=0.5\rho_{air}*(V_{des,\beta})^2*C_{fig}*C_{dyn}$	*2.4 (AS1170.2)*
WIND DIRECTION 1 (Perpendicular to Length)					
Internal Pressure					
Opening Assumption					
	With Dominant Opening (Cpi = n x Cpe)				
Internal Pressure Coefficient (Without Dominant) **MIN**		-0.1			
Internal Pressure Coefficient (Without Dominant) **MAX**		0.2			
Internal Pressure Coefficient (With Dominant) **MIN**		0			
Internal Pressure Coefficient (With Dominant) **MAX**		0.3			
N		0.7		*Cpi= N*Cpe*	
Combination Factor	$K_{C,i}$	1			
Internal Pressure Coefficient **MIN**	$C_{p,i}$	0.70			
Internal Pressure Coefficient **MAX**	$C_{p,i}$	0.70			
External Pressure					
1. Windward Wall					
External Pressure Coefficient	$C_{P,e}$	0.7			
Area Reduction Factor	K_a	1			*Table 5.4*
combination factor applied to internal pressures	$K_{C,e}$	0.8			
local pressure factor	K_l	1			
porous cladding reduction factor	K_p	1			
aerodynamic shape factor	$C_{fig,e}$	0.56			
Wind Wall Pressure	P	**0.14**	**kPa**		
Edge Column Force	F	**0.21**	**kN/m**		
Intermediate Column Force	F	**0.41**	**kN/m**		
2. Leeward Wall					

External Pressure Coefficient	$C_{P,e}$	-0.4			
Area Reduction Factor	K_a	1			*Table 5.4*
combination factor applied to internal pressures	$K_{C,e}$	0.8			
local pressure factor	K_l	1			
porous cladding reduction factor	K_p	1			
aerodynamic shape factor	$C_{fig,e}$	-0.32			
Lee Wall Pressure	P	**-0.08**	**kPa**		
Edge Column Force	F	**-0.12**	**kN/m**		
Intermediate Column Force	F	**-0.24**	**kN/m**		
3. Side Wall					
Area Reduction Factor	K_a	1			*Table 5.4*
combination factor applied to internal pressures	$K_{C,e}$	0.8			
local pressure factor	K_l	1			
porous cladding reduction factor	K_p	1			
External Pressure Coefficient	$C_{P,e}$	-0.65		*0 to 1h*	
External Pressure Coefficient	$C_{P,e}$	-0.5		*1h to 2h*	
External Pressure Coefficient	$C_{P,e}$	-0.3		*2h to 3h*	
External Pressure Coefficient	$C_{P,e}$	-0.2		*>3h*	
aerodynamic shape factor	$C_{fig,e}$	-0.52		*0 to 1h*	
aerodynamic shape factor	$C_{fig,e}$	-0.4		*1h to 2h*	
aerodynamic shape factor	$C_{fig,e}$	-0.24		*2h to 3h*	
aerodynamic shape factor	$C_{fig,e}$	-0.16		*>3h*	
Side Wall Pressure	P	**-0.13**	**kPa**	*0 to 1h*	
Side Wall Pressure	P	**-0.10**	**kPa**	*1h to 2h*	
Side Wall Pressure	P	**-0.06**	**kPa**	*2h to 3h*	
Side Wall Pressure	P	**-0.04**	**kPa**	*>3h*	
4. Roof Up Wind Slope				*α>10º*	
Area Reduction Factor	K_a	1			
combination factor applied to internal pressures	$K_{C,e}$	0.8			
local pressure factor	K_l	1			
porous cladding reduction factor	K_p	1			
External Pressure Coefficient **MIN**	$C_{P,e}$	-0.32			
External Pressure Coefficient **MAX**	$C_{P,e}$	0.15			
aerodynamic shape factor **MIN**	$C_{fig,e}$	-0.26			
aerodynamic shape factor **MAX**	$C_{fig,e}$	0.12			

Pressure **MIN**	P	**-0.06**	**kPa**		
Pressure **MAX**	P	**0.03**	**kPa**		
Edge Rafter Force **MIN**	F	**-0.09**	**kN/m**		
Edge Rafter Force **Max**	F	**0.04**	**kN/m**		
Intermediate Rafter Force **MIN**	F	**-0.19**	**kN/m**		
Intermediate Rafter Force **MAX**	F	**0.09**	**kN/m**		
5. Roof Down Wind Slope					
Area Reduction Factor	K_a	1			
combination factor applied to internal pressures	$K_{C,e}$	0.8			
local pressure factor	K_l	1			
porous cladding reduction factor	K_p	1			
External Pressure Coefficient	$C_{P,e}$	-0.6			
aerodynamic shape factor	$C_{fig,e}$	-0.48			
Pressure **MIN**	P	**-0.12**	**kPa**		
Pressure **MAX**	P	**-0.12**	**kPa**		
Edge Rafter Force **MIN**	F	**-0.18**	**kN/m**		
Edge Rafter Force **MAX**	F	**-0.18**	**kN/m**		
Intermediate Rafter Force **MIN**	F	**-0.35**	**kN/m**		
Intermediate Rafter Force **MAX**	F	**-0.35**	**kN/m**		

WIND DIRECTION 2 (Parallel to Length)					
Internal Pressure					
Opening Assumption					
	With Dominant Opening (Cpi = n x Cpe)				
Internal Pressure Coefficient (Without Dominant) **MIN**					
Internal Pressure Coefficient (Without Dominant) **MAX**					
Internal Pressure Coefficient (With Dominant) **MIN**					
Internal Pressure Coefficient (With Dominant) **MAX**					
N		0.7		*Cpi= N*Cpe*	
Combination Factor	$K_{C,i}$	1			
Internal Pressure Coefficient **MIN**	$C_{p,i}$	0.70			
Internal Pressure Coefficient **MAX**	$C_{p,i}$	0.70			

External Pressure					
1. Windward Wall					
External Pressure Coefficient	$C_{P,e}$	0.7			
Area Reduction Factor	K_a	1			*Table 5.4*
combination factor applied to internal pressures	$K_{C,e}$	0.8			
local pressure factor	K_l	1			
porous cladding reduction factor	K_p	1			
aerodynamic shape factor	$C_{fig,e}$	0.56			
Wind Wall Pressure	P	**0.14**	**kPa**		
Edge Column Force	F	**0.21**	**kN/m**		
Intermediate Column Force	F	**0.41**	**kN/m**		
2. Leeward Wall					
External Pressure Coefficient	$C_{P,e}$	-0.5			
Area Reduction Factor	K_a	1			*Table 5.4*
combination factor applied to internal pressures	$K_{C,e}$	0.8			
local pressure factor	K_l	1			
porous cladding reduction factor	K_p	1			
aerodynamic shape factor	$C_{fig,e}$	-0.4			
Lee Wall Pressure	P	**-0.10**	**kPa**		
Edge Column Force	F	**-0.15**	**kN/m**		
Intermediate Column Force	F	**-0.29**	**kN/m**		
3. Side Wall					
Area Reduction Factor	K_a	1			*Table 5.4*
combination factor applied to internal pressures	$K_{C,e}$	0.8			
local pressure factor	K_l	1			
porous cladding reduction factor	K_p	1			
External Pressure Coefficient	$C_{P,e}$	-0.65		*0 to 1h*	
External Pressure Coefficient	$C_{P,e}$	-0.5		*1h to 2h*	
External Pressure Coefficient	$C_{P,e}$	-0.3		*2h to 3h*	
External Pressure Coefficient	$C_{P,e}$	-0.2		*>3h*	
aerodynamic shape factor	$C_{fig,e}$	-0.52		*0 to 1h*	
aerodynamic shape factor	$C_{fig,e}$	-0.4		*1h to 2h*	

Side Wall Pressure	**P**	**-0.13**	**kPa**	*0 to 1h*
Side Wall Pressure	**P**	**-0.10**	**kPa**	*1h to 2h*
Side Wall Pressure	**P**	**-0.06**	**kPa**	*2h to 3h*
Side Wall Pressure	**P**	**-0.04**	**kPa**	*>3h*
4. Roof				*α<10º*
Area Reduction Factor	K_a	1		
combination factor applied to internal pressures	$K_{C,e}$	0.8		
local pressure factor	K_l	1		
porous cladding reduction factor	K_p	1		
External Pressure Coefficient **MIN**	$C_{P,e}$	-0.9		*0 to 0.5h*
External Pressure Coefficient **MIN**	$C_{P,e}$	-0.9		*0.5 to 1h*
External Pressure Coefficient **MIN**	$C_{P,e}$	-0.5		*1h to 2h*
External Pressure Coefficient **MIN**	$C_{P,e}$	-0.3		*2h to 3h*
External Pressure Coefficient **MIN**	$C_{P,e}$	-0.2		*>3h*
External Pressure Coefficient **MAX**	$C_{P,e}$	-0.4		*0 to 0.5h*
External Pressure Coefficient **MAX**	$C_{P,e}$	-0.4		*0.5 to 1h*
External Pressure Coefficient **MAX**	$C_{P,e}$	0		*1h to 2h*
External Pressure Coefficient **MAX**	$C_{P,e}$	0.1		*2h to 3h*
External Pressure Coefficient **MAX**	$C_{P,e}$	0.2		*>3h*
aerodynamic shape factor **MIN**	$C_{fig,e}$	-0.72		*0 to 0.5h*
aerodynamic shape factor **MIN**	$C_{fig,e}$	-0.72		*0.5 to 1h*
aerodynamic shape factor **MIN**	$C_{fig,e}$	-0.4		*1h to 2h*
aerodynamic shape factor **MIN**	$C_{fig,e}$	-0.24		*2h to 3h*
aerodynamic shape factor **MIN**	$C_{fig,e}$	-0.16		*>3h*
aerodynamic shape factor **MAX**	$C_{fig,e}$	-0.32		*0 to 0.5h*
aerodynamic shape factor **MAX**	$C_{fig,e}$	-0.32		*0.5 to 1h*
aerodynamic shape factor **MAX**	$C_{fig,e}$	0		*1h to 2h*
aerodynamic shape factor **MAX**	$C_{fig,e}$	0.08		*2h to 3h*

aerodynamic shape factor **MAX**	$C_{fig,e}$	0.16		*>3h*	
Pressure **MIN**	**P**	**-0.18**	**kPa**	*0 to 0.5h*	
Pressure **MIN**	**P**	**-0.18**	**kPa**	*0.5 to 1h*	
Pressure **MIN**	**P**	**-0.10**	**kPa**	*1h to 2h*	
Pressure **MIN**	**P**	**-0.06**	**kPa**	*2h to 3h*	
Pressure **MIN**	**P**	**-0.04**	**kPa**	*>3h*	
Pressure **MAX**	**P**	**-0.08**	**kPa**	*0 to 0.5h*	
Pressure **MAX**	**P**	**-0.08**	**kPa**	*0.5 to 1h*	
Pressure **MAX**	**P**	**0.00**	**kPa**	*1h to 2h*	
Pressure **MAX**	**P**	**0.02**	**kPa**	*2h to 3h*	
Pressure **MAX**	**P**	**0.04**	**kPa**	*>3h*	
Edge Purlin Force **MIN**	**F**	**-0.13**	**kN/m**	*0 to 0.5h*	
Edge Purlin Force **MIN**	**F**	**-0.13**	**kN/m**	*0.5 to 1h*	
Edge Purlin Force **MIN**	**F**	**-0.07**	**kN/m**	*1h to 2h*	
Edge Purlin Force **MIN**	**F**	**-0.04**	**kN/m**	*2h to 3h*	
Edge Purlin Force **MIN**	**F**	**-0.03**	**kN/m**	*>3h*	
Edge Purlin Force MAX	**F**	**-0.06**	**kN/m**	*0 to 0.5h*	
Edge Purlin Force MAX	**F**	**-0.06**	**kN/m**	*0.5 to 1h*	
Edge Purlin Force MAX	**F**	**0.00**	**kN/m**	*1h to 2h*	
Edge Purlin Force MAX	**F**	**0.01**	**kN/m**	*2h to 3h*	
Edge Purlin Force MAX	**F**	**0.03**	**kN/m**	*>3h*	
Intermediate Purlin Force **MIN**	**F**	**-0.26**	**kN/m**	*0 to 0.5h*	
Intermediate Purlin Force **MIN**	**F**	**-0.26**	**kN/m**	*0.5 to 1h*	
Intermediate Purlin Force **MIN**	**F**	**-0.15**	**kN/m**	*1h to 2h*	
Intermediate Purlin Force **MIN**	**F**	**-0.09**	**kN/m**	*2h to 3h*	
Intermediate Purlin Force **MIN**	**F**	**-0.06**	**kN/m**	*>3h*	
Intermediate Purlin Force **MAX**	**F**	**-0.12**	**kN/m**	*0 to 0.5h*	
Intermediate Purlin Force **MAX**	**F**	**-0.12**	**kN/m**	*0.5 to 1h*	
Intermediate Purlin Force **MAX**	**F**	**0.00**	**kN/m**	*1h to 2h*	
Intermediate Purlin Force **MAX**	**F**	**0.03**	**kN/m**	*2h to 3h*	
Intermediate Purlin Force **MAX**	**F**	**0.06**	**kN/m**	*>3h*	

4.1.1 Summary

WIND EXTERNAL PRESSURE						
		Wind Direction1 (Perpendicular to Length)		Wind Direction2 (Parallel to Length)		
Windward		0.14		0.14		
Leeward		-0.08		-0.10		
Sidewall	0m - 3.5m	-0.13		-0.13		
	3.5m - 7m	-0.10		-0.10		
	7m - 10.5m	-0.06		-0.06		
	> 10.5m	-0.04		-0.04		
Roof				0m - 1.75m	-0.18	-0.08
	Upwind Slope	-0.06	0.03	1.75m - 3.5m	-0.18	-0.08
				3.5m - 7m	-0.10	0.00
	Downwind Slope	-0.12	-0.12	7m - 10.5m	-0.06	0.02
				>10.5m	-0.04	0.04
Wind Internal Pressure (kPa)						
		0.7 x Cpe	0.7 x Cpe	0.7 x Cpe		0.7 x Cpe

4.2 Wind Load Diagrams

4.2.1 Wind Load Ultimate (W_{min} Direction1)

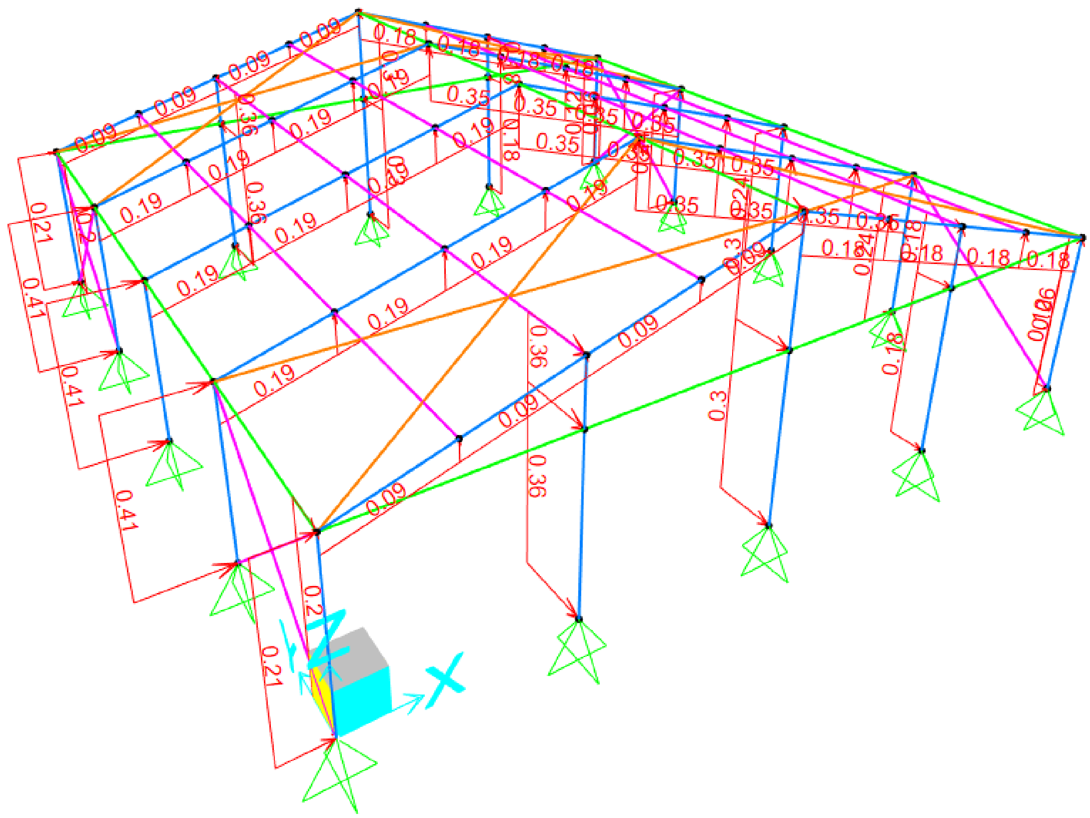

Figure 2 Wind Direction 1 Min

4.2.2 Wind Load Ultimate (W_{max} Direction 1)

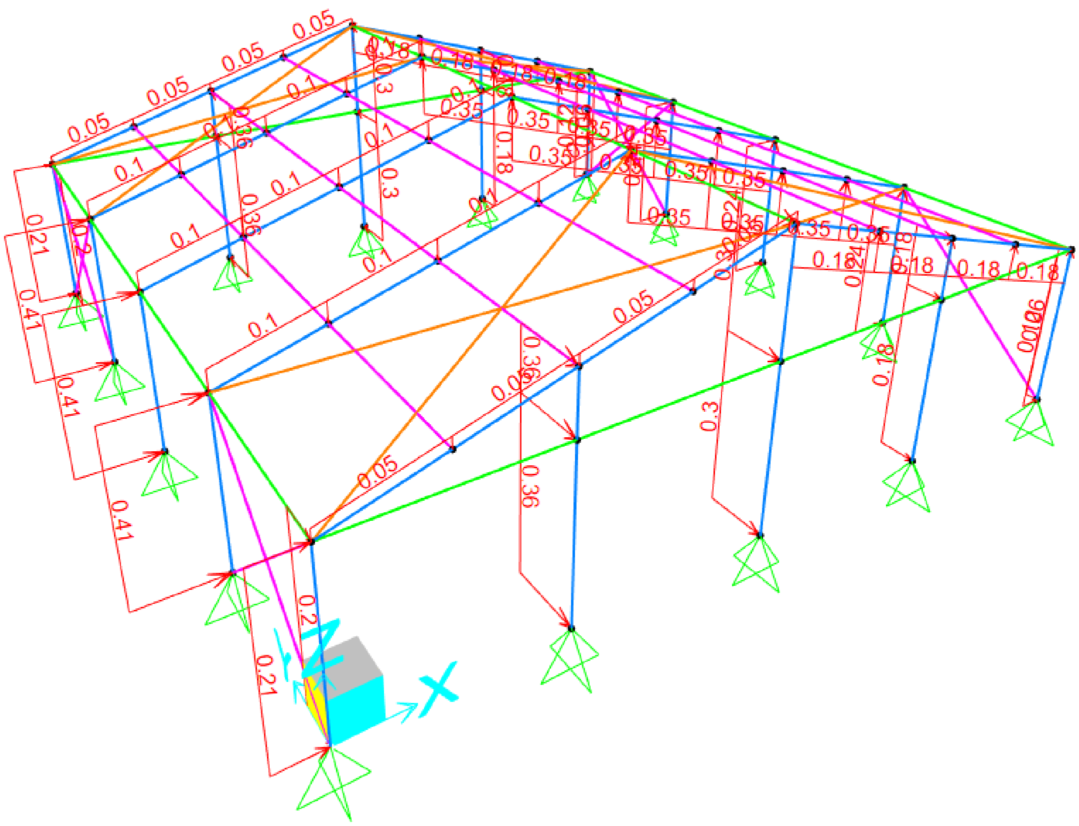

Figure 3 Wind Direction 1 Max

4.2.3 Wind Load Ultimate (W_{min} Direction 2)

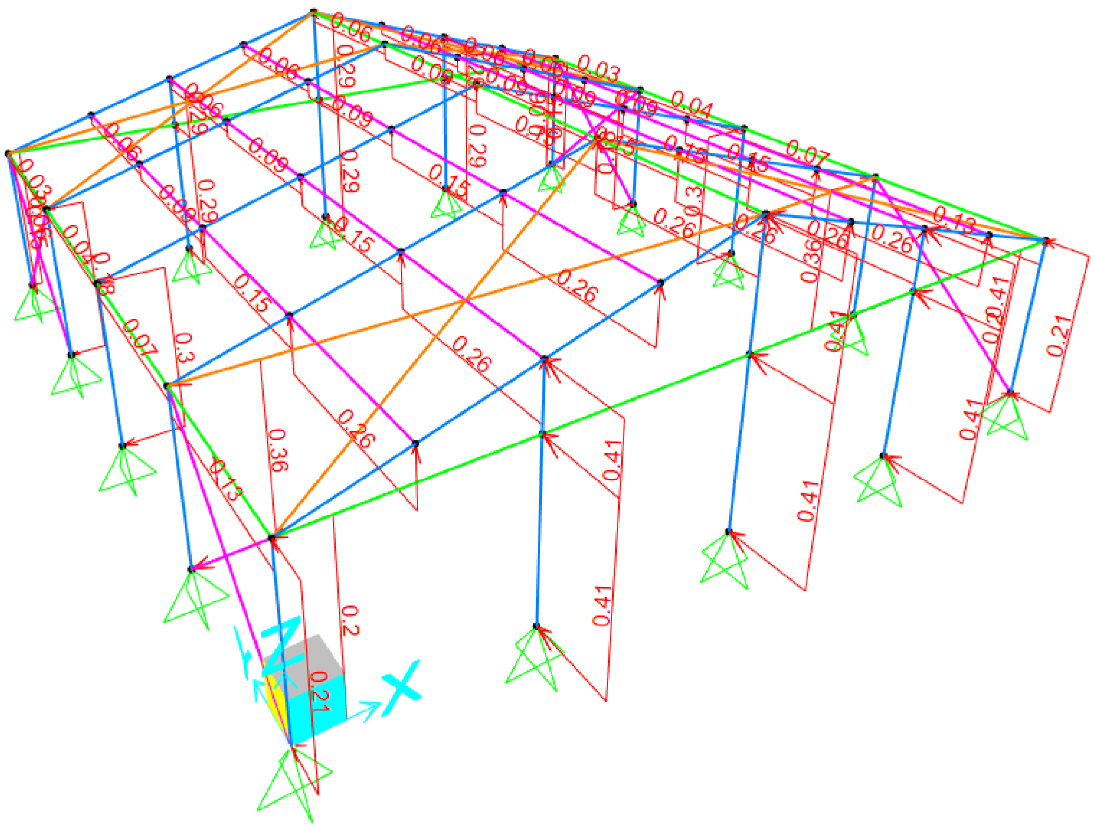

Figure 4Wind Direction 2 Min

4.2.4 Wind Load Ultimate (W_{max} Direction 2)

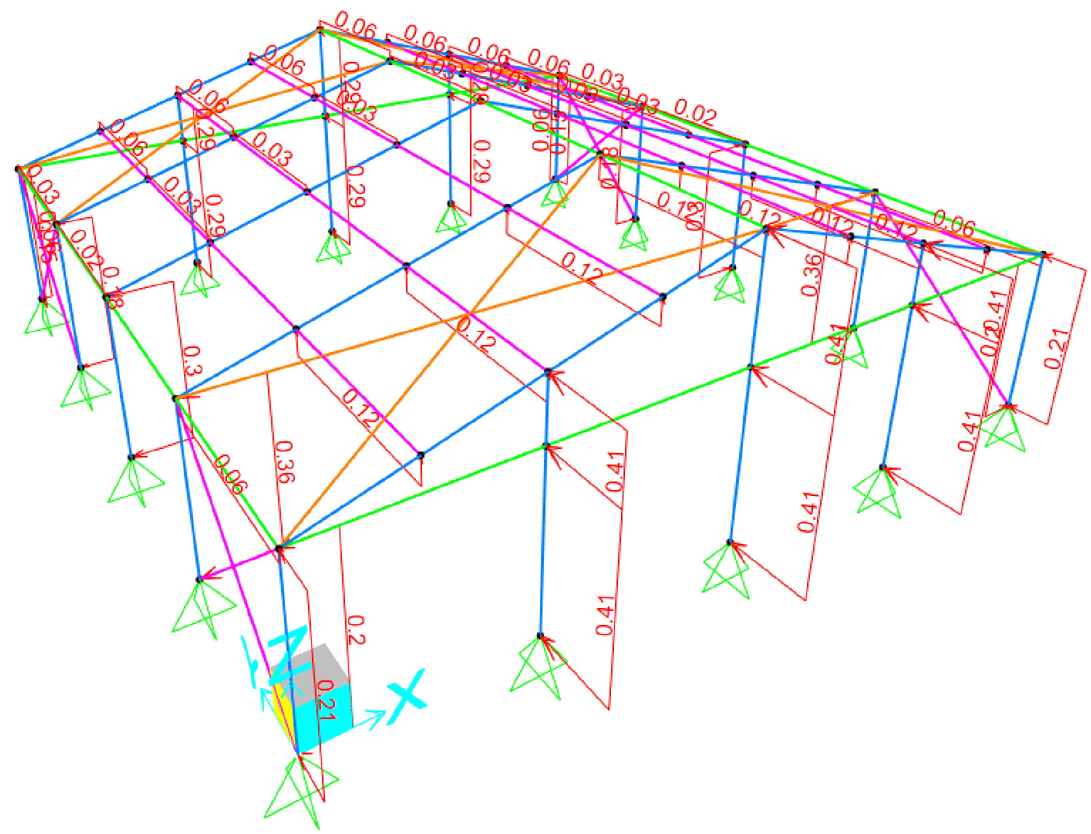

Figure 5 Wind Direction 2 Max

5 Analysis

5.1 Results

5.1.1 Maximum Bending Moment in Major Axis

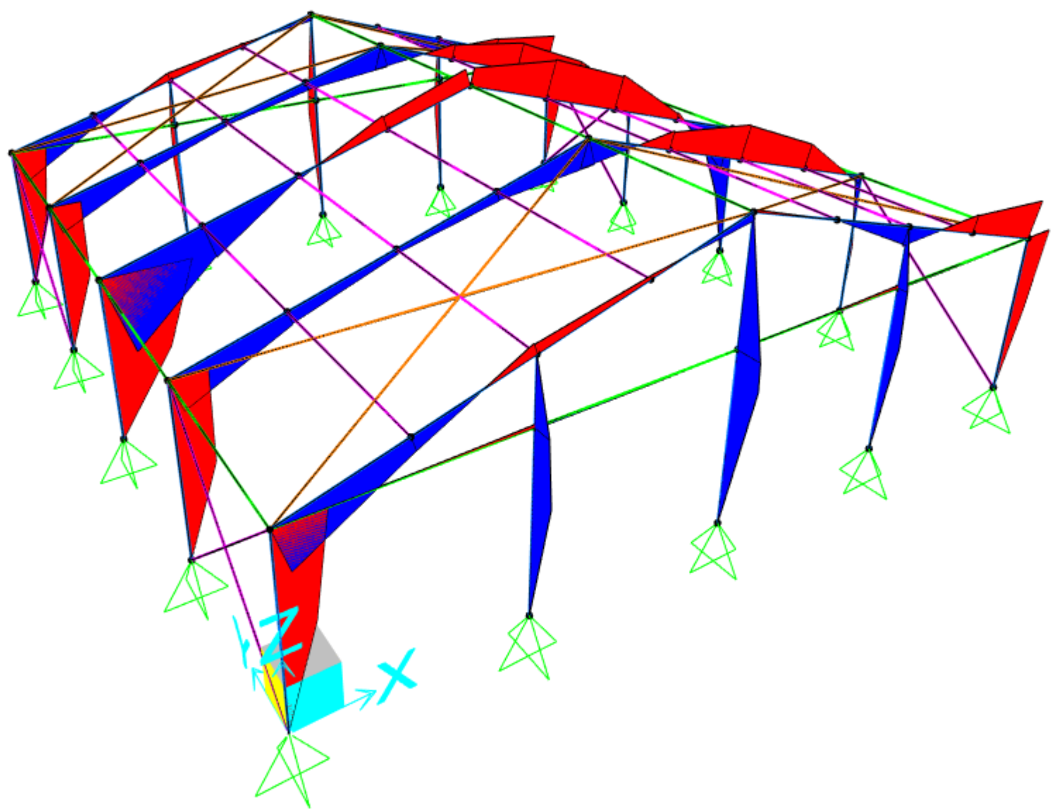

Figure 6 Maximum Bending Moment - Major

5.1.2 Maximum Bending Moment in Minor Axis

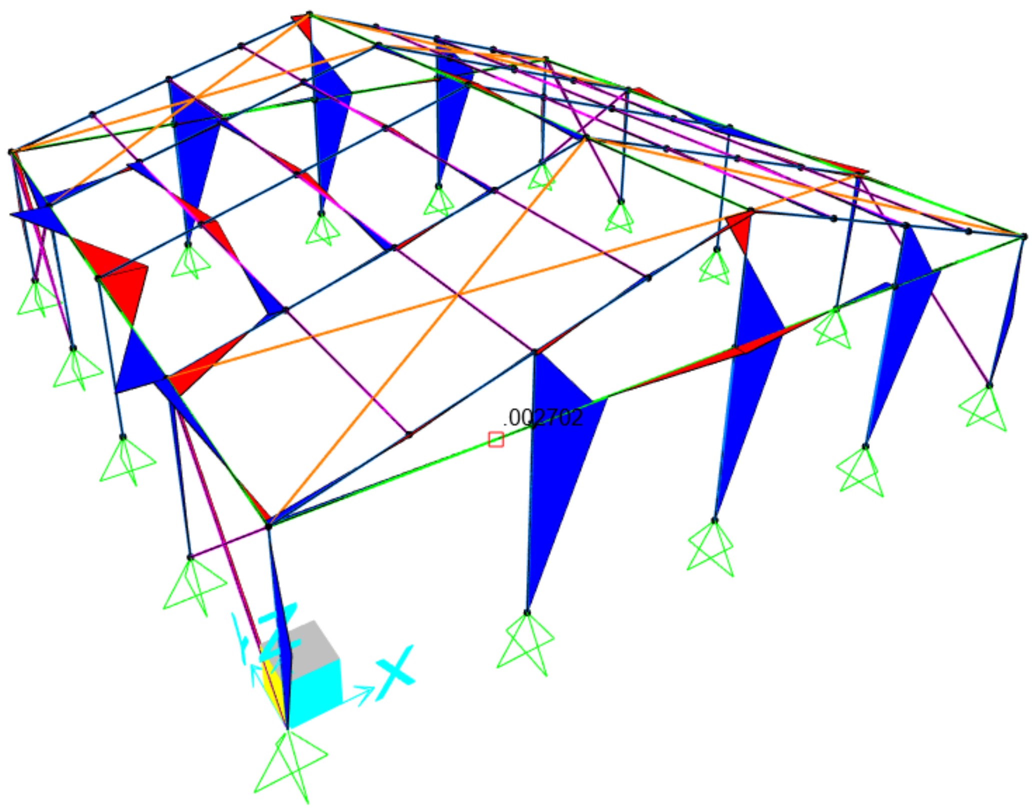

Figure 7: Maximum Bending Moment - Minor

5.1.3 Maximum Shear

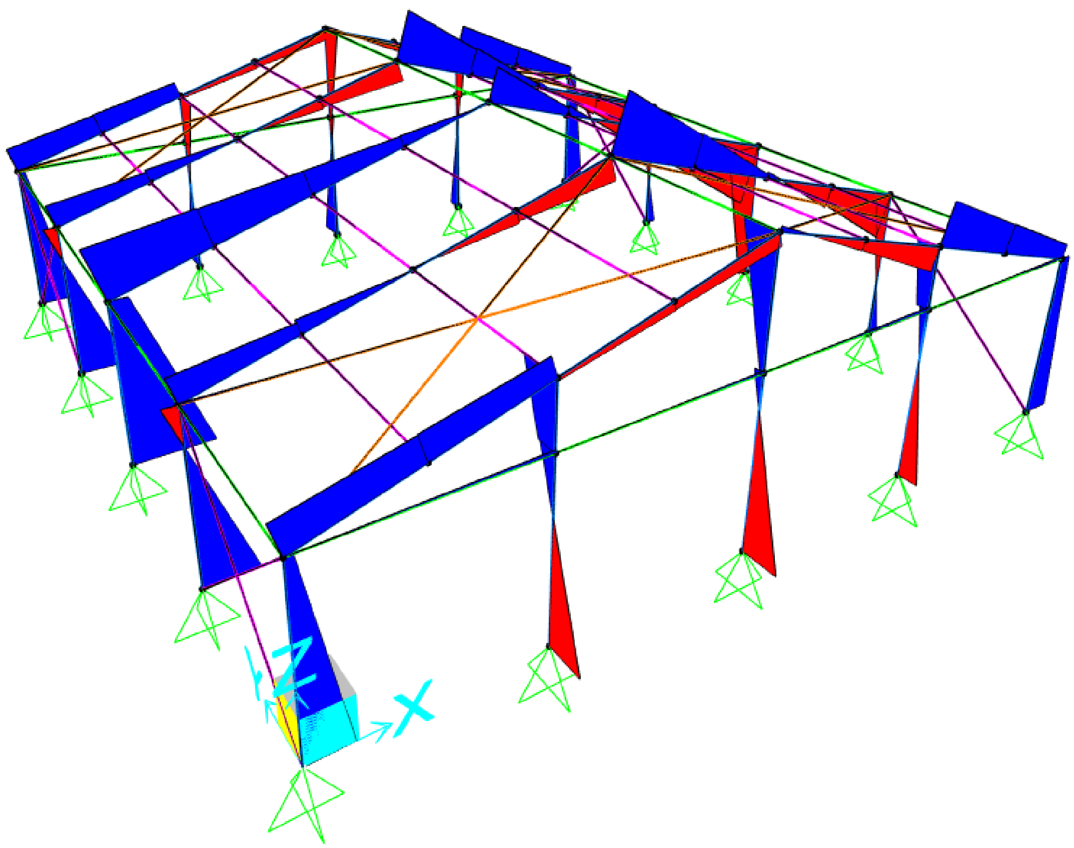

Figure 8 Maximum Shear

5.1.4 Maximum Axial Force

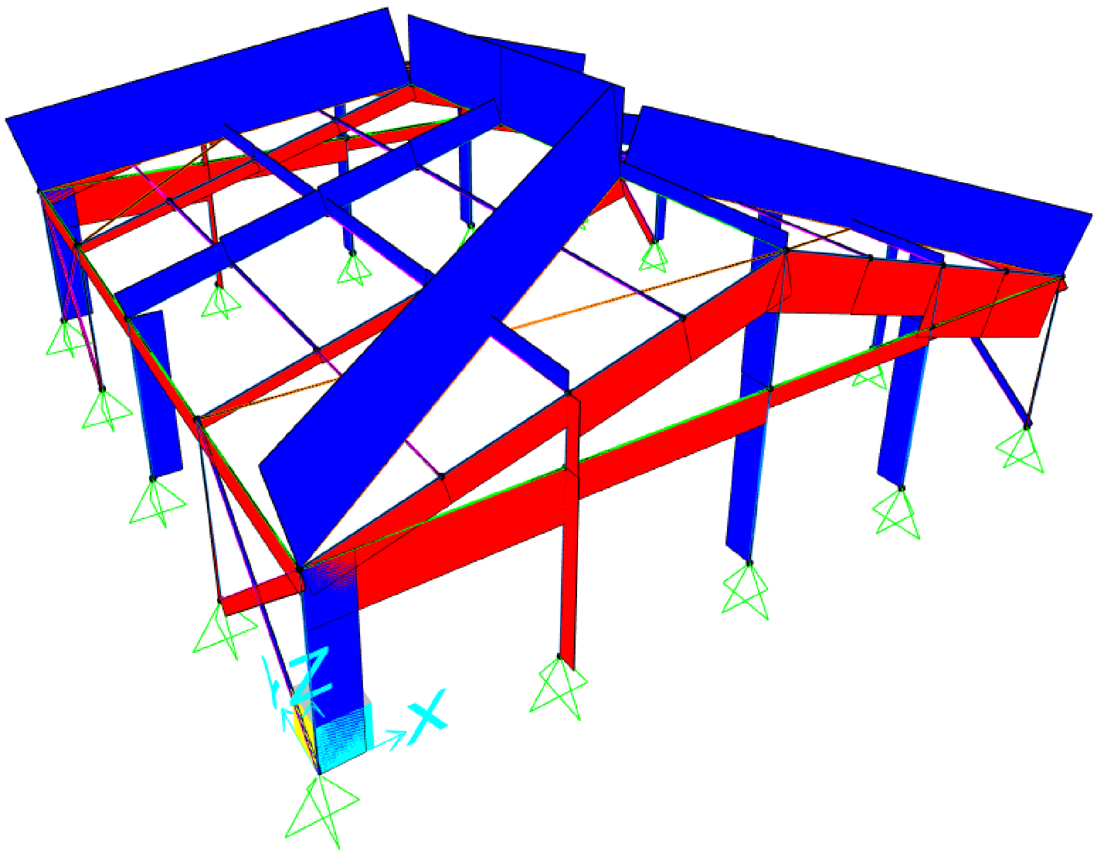

Figure 9 Maximum Axial Force

5.1.5 Maximum Reactions

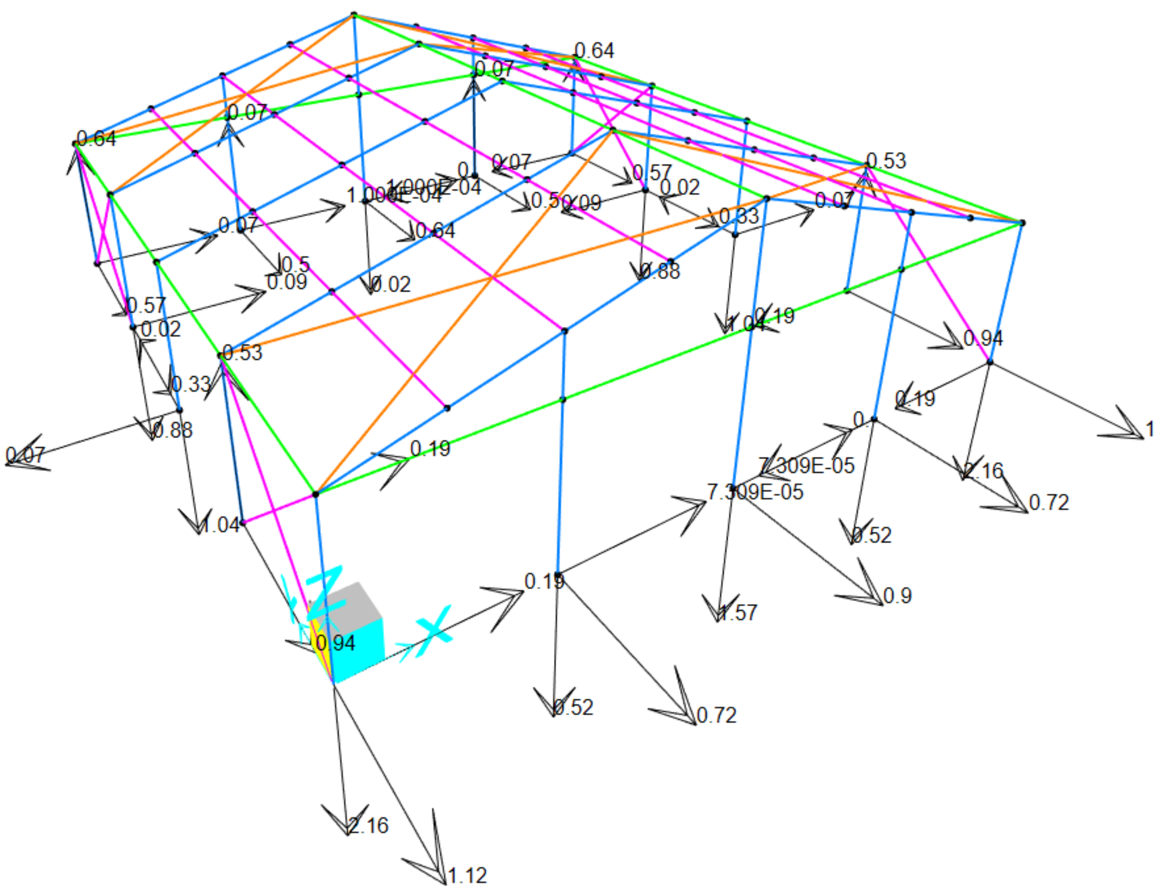

Figure 10 Maximum Reaction

Fx = 2.45 kN

Fy = 1.97 kN

$F_{z(up\ lift)}$ = 2.6 kN

$F_{z\ (Bearing)}$ = 4.05 kN

6 Aluminium Member Design

All Aluminium members passed. The summary results are tabulated below. Refer to Appendix 'A' for details.

MEMBER(S)	Section	b	d	t	Vx	Vy	P (Axial)	Mx	My
		mm	mm	mm	kN	kN	kN	kN.m	kN.m
Rafter	100x48x3	48	100	3	1.793	-0.00266	2.025	4.0262	-0.0031
Upright Support	100x48x3	48	100	3	0.641	-0.00057	2.27	-4.0233	0.0015
Gable Pole	84x48x3	48	84	3	0.509	-0.423	-2.019	0.7455	1.0996
Ridge & Eave Purlin	45x60x2	60	45	2	0.015	0.374	-1.39	-6.939E-18	-0.5987
Gable Beam	45x60x2	60	45	2	0.047	0.012	-3.333	-0.0989	-0.0007684
Intermediate Purlin	40x40x2	40	40	2	-0	0.014	-0.333	-0.4891	0.0189
Brace	40x40x2	40	40	2	0.011	0.01	-1.903	6.939E-18	-0.0288

7 Ballast Requirements

Tent Span	Wind Region	Wind Speed (km/hr)	Holding-down Weight per Gable Pole (kg)	Holding-down Weight per Upright Support (kg)
12m	A	80	350	450
10m	A	80	350	450
9m	A	80	300	380
8m	A	80	275	350
6m	A	80	250	300

8 Summary and Recommendations

- The structure is for temporary use only and shall not remain erected for more than 6 months period.
- The temporary 12m X 12m Tent Structure as specified is capable of withstanding **22.22 m/s Wind Loads.**
- For ballast requirements, refer to Cl. 7.
- For forecast winds in excess of **80km/hr** all fabrics should be removed and the erected structure to be dismantled.
- Wall Bracing and roof bracing are required at each end bay and every third bay in between to resist against lateral movement due to wind direction2.
- Maximum Intermediate purlin spacing shall not exceed 1500mm for 40x40x2 purlin profiles.
- Roof cable bracings are required to have minimum **10kN SWL**.
- The bearing pressure of soil should be clarified and checked by an engineer prior to erection foundation and base plate considerations.

Yours faithfully,

Prime Consulting Engineers Pty. Ltd.

Kevin Zia, BEng, Meng, MIEAust, CPENG NER

9 Appendix A – Aluminium Design Based on AS1664.1

9.1 Upright Support

PRIME CONSULTING ENGINEERS PTY. LTD

Job no. 23-573-3 **Date:** 6/07/2023

NAME	SYMBOL		VALUE	UNIT	NOTES	REF
100x48x3	**Upright Support**					
Alloy and temper	6061-T6					AS1664.1
Tension	F_{tu}	=	262	MPa	*Ultimate*	T3.3(A)
	F_{ty}	=	241	MPa	*Yield*	
Compression	F_{cy}	=	241	MPa		
Shear	F_{su}	=	165	MPa	*Ultimate*	
	F_{sy}	=	138	MPa	*Yield*	
Bearing	F_{bu}	=	551	MPa	*Ultimate*	
	F_{by}	=	386	MPa	*Yield*	
Modulus of elasticity	E	=	70000	MPa	*Compressive*	
	k_t	=	1			T3.4(B)
	k_c	=	1			
FEM ANALYSIS RESULTS						
Axial force	P	=	0	kN	*compression*	
	P	=	2.27	kN	*Tension*	
In plane moment	M_x	=	4.0233	kNm		
Out of plane moment	M_y	=	0.0015	kNm		
DESIGN STRESSES						
Gross cross section area	A_g	**=**	852	mm^2		
In-plane elastic section modulus	Z_x	**=**	21859.12	mm^3		
Out-of-plane elastic section mod.	Z_y	**=**	14218.5	mm^3		
Stress from axial force	$\mathbf{f_a}$	**=**	P/A_g			
		=	**0.00**	**MPa**	*compression*	
		=	**2.66**	**MPa**	*Tension*	
Stress from in-plane bending	$\mathbf{f_{bx}}$	**=**	M_x/Z_x			

		=	**184.06**	**MPa**	*compression*	
Stress from out-of-plane bending	**f_{by}**	=	M_y/Z_y			
		=	**0.11**	**MPa**	*compression*	
Tension						
***3.4.3** Tension in rectangular tubes*						
	ϕF_L	=	**228.95**	**MPa**		
		OR				
	ϕF_L	=	**222.70**	**MPa**		
COMPRESSION						
***3.4.8** Compression in columns, axial, gross section*						
1. General						… 3.4.8.1
Unsupported length of member	L	=	4000	mm		
Effective length factor	k	=	1.00			
Radius of gyration about buckling axis (Y)	r_y	=	20.01	mm		
Radius of gyration about buckling axis (X)	r_x	=	35.82	mm		
Slenderness ratio	kLb/ry	=	199.87			
Slenderness ratio	kL/rx	=	111.68			
Slenderness parameter	λ	=	3.73			
	D_c*	=	90.3			
	S_1*	=	0.33			
	S_2*	=	1.23			
	ϕ_{cc}	=	0.950			
Factored limit state stress	**ϕF_L**	=	**16.43**	**MPa**		
2. Sections not subject to torsional or torsional-flexural buckling						… 3.4.8.2
Largest slenderness ratio for flexural buckling	kL/r	=	199.87			
***3.4.10** Uniform compression in components of columns, gross section - flat plates*						
1. Uniform compression in components of columns, gross section - flat plates with both edges supported						… 3.4.10.1
	k_1	=	0.35			T3.3(D)
Max. distance between toes of fillets of supporting elements for plate	b'	=	42			
	t	=	3	mm		
Slenderness	b/t	=	14			
Limit 1	S_1	=	12.34			

Limit 2	S_2	=	32.87			
Factored limit state stress	**ϕF_L**	=	**224.30**	**MPa**		
Most adverse compressive limit state stress	F_a	=	16.43	MPa		
Most adverse tensile limit state stress	F_a	=	222.70	MPa		
Most adverse compressive & Tensile capacity factor	f_a/F_a	=	0.01		PASS	
BENDING - IN-PLANE						
3.4.15 *Compression in beams, extreme fibre, gross section rectangular tubes, box sections*						
Unbraced length for bending	L_b	=	4000	mm		
Second moment of area (weak axis)	I_y	=	3.41E+05	mm^4		
Torsion modulus	J	=	8.05E+05	mm^3		
Elastic section modulus	Z	=	21859.12	mm^3		
Slenderness	S	=	333.64			
Limit 1	S_1	=	0.39			
Limit 2	S_2	=	1695.86			
Factored limit state stress	**ϕF_L**	=	**188.49**	**MPa**		... 3.4.15(2)
3.4.17 *Compression in components of beams (component under uniform compression), gross section - flat plates with both edges supported*						
	k_1	=	0.5			T3.3(D)
	k_2	=	2.04			T3.3(D)
Max. distance between toes of fillets of supporting elements for plate	b'	=	42	mm		
	t	=	3	mm		
Slenderness	b/t	=	14			
Limit 1	S_1	=	12.34			
Limit 2	S_2	=	46.95			
Factored limit state stress	**ϕF_L**	=	**224.30**	**MPa**		
Most adverse in-plane bending limit state stress	F_{bx}	=	188.49	MPa		
Most adverse in-plane bending capacity factor	f_{bx}/F_{bx}	=	0.98		PASS	

BENDING - OUT-OF-PLANE						
NOTE: Limit state stresses, ϕF_L are the same for out-of-plane bending (doubly symmetric section)						
Factored limit state stress	**ϕF_L**	=	**188.49**	**MPa**		
Most adverse out-of-plane bending limit state stress	**F_{by}**	=	188.49	MPa		
Most adverse out-of-plane bending capacity factor	**f_{by}/F_{by}**	=	0.00		PASS	
COMBINED ACTIONS						
***4.1.1** Combined compression and bending*						… 4.1.1(2)
	F_a	=	16.43	MPa		… 3.4.8
	F_{ao}	=	224.30	MPa		… 3.4.10
	F_{bx}	=	188.49	MPa		… 3.4.17
	F_{by}	=	188.49	MPa		… 3.4.17
	f_a/F_a	=	0.012			
Check:	$f_a/F_a + f_{bx}/F_{bx} + f_{by}/F_{by} \leq 1.0$					… 4.1.1 (3)
i.e.	0.99	≤	1.0		PASS	
SHEAR						
***3.4.24** Shear in webs (Major Axis)*						… 4.1.1(2)
Clear web height	h	=	94	mm		
	t	=	3	mm		
Slenderness	h/t	=	31.333333			
Limit 1	S_1	=	29.01			
Limit 2	S_2	=	59.31			
Factored limit state stress	**ϕF_L**	=	**128.74**	**MPa**		
Stress From Shear force	**f_{sx}**	=	V/A_w			
			0.90	**MPa**		
***3.4.25** Shear in webs (Minor Axis)*						
Clear web height	b	=	42	mm		
	t	=	3	mm		
Slenderness	b/t	=	14			
Factored limit state stress	**ϕF_L**	=	**131.10**	**MPa**		

Stress From Shear force	f_{sy}	=	V/A_w			
			0.00	**MPa**		
Most adverseshear capacity factor (Major Axis)	f_{sx}/F_{sx}	=	0.01	**MPa**		
Most adverseshear capacity factor (Minor Axis)	f_{sy}/F_{sy}	=	0.00	**Mpa**	PASS	
COMBINED ACTIONS						
***4.4** Combined Shear, Compression and bending*						
Check: $f_a/F_a + f_b/F_b + (f_s/F_s)^2 \leq 1.0$						
i.e.	0.99	≤	1.0		PASS	

9.2 Rafter

PRIME CONSULTING ENGINEERS PTY. LTD

Job no. 23-573-3 **Date:** 6/07/2023

NAME	SYMBOL		VALUE	UNIT	NOTES	REF
100x48x3	**Rafter**					
Alloy and temper	6061-T6					AS1664.1
Tension	F_{tu}	=	262	MPa	*Ultimate*	T3.3(A)
	F_{ty}	=	241	MPa	*Yield*	
Compression	F_{cy}	=	241	MPa		
Shear	F_{su}	=	165	MPa	*Ultimate*	
	F_{sy}	=	138	MPa	*Yield*	
Bearing	F_{bu}	=	551	MPa	*Ultimate*	
	F_{by}	=	386	MPa	*Yield*	
Modulus of elasticity	E	=	70000	MPa	*Compressive*	
	k_t	=	1			T3.4(B)
	k_c	=	1			
FEM ANALYSIS RESULTS						
Axial force	P	=	0	kN	*compression*	

	P	=	2.025	kN	*Tension*	
In plane moment	M_x	=	4.0262	kNm		
Out of plane moment	M_y	=	0.0031	kNm		
DESIGN STRESSES						
Gross cross section area	A_g	**=**	852	mm²		
In-plane elastic section modulus	Z_x	**=**	21859.12	mm³		
Out-of-plane elastic section mod.	Z_y	**=**	14218.5	mm³		
Stress from axial force	$\mathbf{f_a}$	**=**	P/A_g			
		=	**0.00**	**MPa**	*compression*	
		=	**2.38**	**MPa**	*Tension*	
Stress from in-plane bending	$\mathbf{f_{bx}}$	**=**	M_x/Z_x			
		=	**184.19**	**MPa**	*compression*	
Stress from out-of-plane bending	$\mathbf{f_{by}}$	**=**	M_y/Z_y			
		=	**0.22**	**MPa**	*compression*	
Tension						
***3.4.3** Tension in rectangular tubes*						
	$\boldsymbol{\phi F_L}$	**=**	**228.95**	**MPa**		
		OR				
	$\boldsymbol{\phi F_L}$	**=**	**222.70**	**MPa**		
COMPRESSION						
***3.4.8** Compression in columns, axial, gross section*						
1. General						… 3.4.8.1
Unsupported length of member	L	=	6260	mm		
Effective length factor	k	=	1.00			
Radius of gyration about buckling axis (Y)	r_y	=	20.01	mm		
Radius of gyration about buckling axis (X)	r_x	=	35.82	mm		
Slenderness ratio	kLb/ry	=	74.95			
Slenderness ratio	kL/rx	=	174.78			
Slenderness parameter	λ	=	3.264			
	D_c^*	=	90.3			
	S_1^*	=	0.33			
	S_2^*	=	1.23			
	ϕ_{cc}	=	0.950			
Factored limit state stress	$\boldsymbol{\phi F_L}$	**=**	**21.49**	**MPa**		

Address: Level M 394 Lane Cove Rd
Macquarie Park NSW 2113
Phone: (02) 8964 1818

2. Sections not subject to torsional or torsional-flexural buckling						… 3.4.8.2
Largest slenderness ratio for flexural buckling	kL/r	=	174.78			
***3.4.10** Uniform compression in components of columns, gross section - flat plates*						
1. Uniform compression in components of columns, gross section - flat plates with both edges supported						… 3.4.10.1
	k_1	=	0.35			T3.3(D)
Max. distance between toes of fillets of supporting elements for plate	b'	=	42			
	t	=	3	mm		
Slenderness	b/t	=	14			
Limit 1	S_1	=	12.34			
Limit 2	S_2	=	32.87			
Factored limit state stress	**ϕF_L**	=	**224.30**	**MPa**		
Most adverse compressive limit state stress	F_a	=	21.49	MPa		
Most adverse tensile limit state stress	F_a	=	222.70	MPa		
Most adverse compressive & Tensile capacity factor	f_a/F_a	=	0.01		PASS	
BENDING - IN-PLANE						
***3.4.15** Compression in beams, extreme fibre, gross section rectangular tubes, box sections*						
Unbraced length for bending	L_b	=	1500	mm		
Second moment of area (weak axis)	I_y	=	3.41E+05	mm^4		
Torsion modulus	J	=	8.05E+05	mm^3		
Elastic section modulus	Z	=	21859.12	mm^3		
Slenderness	S	=	125.11			
Limit 1	S_1	=	0.39			
Limit 2	S_2	=	1695.86			
Factored limit state stress	**ϕF_L**	=	**204.73**	**MPa**		… 3.4.15(2)
***3.4.17** Compression in components of beams (component under uniform compression), gross section - flat plates with both edges supported*						
	k_1	=	0.5			T3.3(D)
	k_2	=	2.04			T3.3(D)

Max. distance between toes of fillets of supporting elements for plate	b'	=	42	mm		
	t	=	3	mm		
Slenderness	b/t	=	14			
Limit 1	S_1	=	12.34			
Limit 2	S_2	=	46.95			
Factored limit state stress	**ϕF_L**	=	**224.30**	**MPa**		
Most adverse in-plane bending limit state stress	F_{bx}	=	204.73	MPa		
Most adverse in-plane bending capacity factor	f_{bx}/F_{bx}	=	0.90		PASS	
BENDING - OUT-OF-PLANE						
NOTE: Limit state stresses, ϕF_L are the same for out-of-plane bending (doubly symmetric section)						
Factored limit state stress	**ϕF_L**	=	**204.73**	**MPa**		
Most adverse out-of-plane bending limit state stress	**F_{by}**	=	204.73	MPa		
Most adverse out-of-plane bending capacity factor	**f_{by}/F_{by}**	=	0.00		PASS	
COMBINED ACTIONS						
***4.1.1** Combined compression and bending*						… 4.1.1(2)
	F_a	=	21.49	MPa		… 3.4.8
	F_{ao}	=	224.30	MPa		… 3.4.10
	F_{bx}	=	204.73	MPa		… 3.4.17
	F_{by}	=	204.73	MPa		… 3.4.17
	f_a/F_a	=	0.011			
Check:	$f_a/F_a + f_{bx}/F_{bx} + f_{by}/F_{by} \leq 1.0$					… 4.1.1 (3)
i.e.	0.91	≤	1.0		PASS	
SHEAR						
***3.4.24** Shear in webs (Major Axis)*						… 4.1.1(2)
Clear web height	h	=	94	mm		
	t	=	3	mm		
Slenderness	h/t	=	31.333333			

Limit 1	S_1	=	29.01			
Limit 2	S_2	=	59.31			
Factored limit state stress	**ϕF_L**	=	**128.74**	**MPa**		
Stress From Shear force	**f_{sx}**	=	V/A_w			
			2.53	**MPa**		
***3.4.25** Shear in webs (Minor Axis)*						
Clear web height	b	=	42	mm		
	t	=	3	mm		
Slenderness	b/t	=	14			
Factored limit state stress	**ϕF_L**	=	**131.10**	**MPa**		
Stress From Shear force	**f_{sy}**	=	V/A_w			
			0.00	**MPa**		
Most adverseshear capacity factor (Major Axis)	f_{sx}/F_{sx}	=	0.02	**MPa**		
Most adverseshear capacity factor (Minor Axis)	f_{sy}/F_{sy}	=	0.00	**Mpa**	PASS	
COMBINED ACTIONS						
***4.4** Combined Shear, Compression and bending*						
Check:	$f_a/F_a + f_b/F_b + (f_s/F_s)^2 \leq 1.0$					
i.e.	0.91	$\leq$	1.0		PASS	

9.3 Gable Pole

PRIME CONSULTING ENGINEERS PTY. LTD

Job no. 23-573-3 **Date:** 06/07/2023

NAME	SYMBOL		VALUE	UNIT	NOTES	REF
84x48x3	**Gable Pole**					
Alloy and temper	6061-T6					AS1664.1
Tension	F_{tu}	=	262	MPa	*Ultimate*	T3.3(A)
	F_{ty}	=	241	MPa	*Yield*	
Compression	F_{cy}	=	241	MPa		

Shear	F_{su}	=	165	MPa	*Ultimate*	
	F_{sy}	=	138	MPa	*Yield*	
Bearing	F_{bu}	=	551	MPa	*Ultimate*	
	F_{by}	=	386	MPa	*Yield*	
Modulus of elasticity	E	=	70000	MPa	*Compressive*	
	k_t	=	1			T3.4(B)
	k_c	=	1			
FEM ANALYSIS RESULTS						
Axial force	P	=	2.019	kN	*compression*	
	P	=	0	kN	*Tension*	
In plane moment	M_x	=	0.7455	kNm		
Out of plane moment	M_y	=	1.0996	kNm		
DESIGN STRESSES						
Gross cross section area	A_g	**=**	756	mm^2		
In-plane elastic section modulus	Z_x	**=**	16902	mm^3		
Out-of-plane elastic section mod.	Z_y	**=**	12190.5	mm^3		
Stress from axial force	$\mathbf{f_a}$	**=**	P/A_g			
		=	**2.67**	**MPa**	*compression*	
		=	**0.00**	**MPa**	*Tension*	
Stress from in-plane bending	$\mathbf{f_{bx}}$	**=**	M_x/Z_x			
		=	**44.11**	**MPa**	*compression*	
Stress from out-of-plane bending	$\mathbf{f_{by}}$	**=**	M_y/Z_y			
		=	**90.20**	**MPa**	*compression*	
Tension						
***3.4.3** Tension in rectangular tubes*						
	$\mathbf{\phi F_L}$	**=**	**228.95**	**MPa**		
		OR				
	$\mathbf{\phi F_L}$	**=**	**222.70**	**MPa**		
COMPRESSION						
***3.4.8** Compression in columns, axial, gross section*						
1. General						… 3.4.8.1
Unsupported length of member	L	=	4400	mm		
Effective length factor	k	=	1.00			

Radius of gyration about buckling axis (Y)	r_y	=	19.67	mm		
Radius of gyration about buckling axis (X)	r_x	=	30.64	mm		
Slenderness ratio	kLb/ry	=	152.50			
Slenderness ratio	kL/rx	=	143.59			
Slenderness parameter	λ	=	2.85			
	D_c*	=	90.3			
	S_1*	=	0.33			
	S_2*	=	1.23			
	ϕ_{cc}	=	0.950			
Factored limit state stress	**ϕF_L**	**=**	**28.22**	**MPa**		
2. Sections not subject to torsional or torsional-flexural buckling						… 3.4.8.2
Largest slenderness ratio for flexural buckling	kL/r	=	152.50			
***3.4.10** Uniform compression in components of columns, gross section - flat plates*						
1. Uniform compression in components of columns, gross section - flat plates with both edges supported						… 3.4.10.1
	k_1	=	0.35			T3.3(D)
Max. distance between toes of fillets of supporting elements for plate	b'	=	42			
	t	=	3	mm		
Slenderness	b/t	=	14			
Limit 1	S_1	=	12.34			
Limit 2	S_2	=	32.87			
Factored limit state stress	**ϕF_L**	**=**	**224.30**	**MPa**		
Most adverse compressive limit state stress	F_a	=	28.22	MPa		
Most adverse tensile limit state stress	F_a	=	222.70	MPa		
Most adverse compressive & Tensile capacity factor	f_a/F_a	=	0.09		PASS	
BENDING - IN-PLANE						
***3.4.15** Compression in beams, extreme fibre, gross section rectangular tubes, box sections*						

Unbraced length for bending	L_b	=	3000	mm		
Second moment of area (weak axis)	I_y	=	292572	mm^4		
Torsion modulus	J	=	632667.86	mm^3		
Elastic section modulus	Z	=	16902	mm^3		
Slenderness	S	=	235.71			
Limit 1	S_1	=	0.39			
Limit 2	S_2	=	1695.86			
Factored limit state stress	**ϕF_L**	=	**195.17**	**MPa**		... 3.4.15(2)
3.4.17 *Compression in components of beams (component under uniform compression), gross section - flat plates with both edges supported*						
	k_1	=	0.5			T3.3(D)
	k_2	=	2.04			T3.3(D)
Max. distance between toes of fillets of supporting elements for plate	b'	=	42	mm		
	t	=	3	mm		
Slenderness	b/t	=	14			
Limit 1	S_1	=	12.34			
Limit 2	S_2	=	46.95			
Factored limit state stress	**ϕF_L**	=	**224.30**	**MPa**		
Most adverse in-plane bending limit state stress	F_{bx}	=	195.17	MPa		
Most adverse in-plane bending capacity factor	f_{bx}/F_{bx}	=	0.23		PASS	
BENDING - OUT-OF-PLANE						
NOTE: Limit state stresses, ϕF_L are the same for out-of-plane bending (doubly symmetric section)						
Factored limit state stress	**ϕF_L**	=	**195.17**	**MPa**		
Most adverse out-of-plane bending limit state stress	**F_{by}**	=	195.17	MPa		
Most adverse out-of-plane bending capacity factor	**f_{by}/F_{by}**	=	0.46		PASS	
COMBINED ACTIONS						

***4.1.1** Combined compression and bending* … 4.1.1(2)

	F_a	=	28.22	MPa		… 3.4.8
	F_{ao}	=	224.30	MPa		… 3.4.10
	F_{bx}	=	195.17	MPa		… 3.4.17
	F_{by}	=	195.17	MPa		… 3.4.17
	f_a/F_a	=	0.095			
Check:	$f_a/F_a + f_{bx}/F_{bx} + f_{by}/F_{by} \leq 1.0$					… 4.1.1 (3)
i.e.	0.78	≤	1.0		PASS	

SHEAR

***3.4.24** Shear in webs (Major Axis)* … 4.1.1(2)

Clear web height	h	=	78	mm
	t	=	3	mm
Slenderness	h/t	=	26	
Limit 1	S_1	=	29.01	
Limit 2	S_2	=	59.31	
Factored limit state stress	**ϕF_L**	=	**131.10**	**MPa**
Stress From Shear force	**f_{sx}**	=	V/A_w	
			0.81	**MPa**

***3.4.25** Shear in webs (Minor Axis)*

Clear web height	b	=	42	mm
	t	=	3	mm
Slenderness	b/t	=	14	
Factored limit state stress	**ϕF_L**	=	**131.10**	**MPa**
Stress From Shear force	**f_{sy}**	=	V/A_w	
			0.67	**MPa**

Most adverseshear capacity factor (Major Axis)	f_{sx}/F_{sx}	=	0.01	**MPa**	
Most adverseshear capacity factor (Minor Axis)	f_{sy}/F_{sy}	=	0.01	**Mpa**	PASS

COMBINED ACTIONS

***4.4** Combined Shear, Compresion and bending*

Check: $f_a/F_a + f_b/F_b + (f_s/F_s)^2 \leq 1.0$

i.e.	0.56	≤	1.0	PASS

9.4 Eave & Ridge Purlin

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Job no. 23-573-3 **Date:** 6/07/2023

NAME	SYMBOL		VALUE	UNIT	NOTES	REF
45x60x2	**Ridge & Eave Purlin**					
Alloy and temper	6061-T6					AS1664.1
Tension	F_{tu}	=	262	MPa	*Ultimate*	T3.3(A)
	F_{ty}	=	241	MPa	*Yield*	
Compression	F_{cy}	=	241	MPa		
Shear	F_{su}	=	165	MPa	*Ultimate*	
	F_{sy}	=	138	MPa	*Yield*	
Bearing	F_{bu}	=	551	MPa	*Ultimate*	
	F_{by}	=	386	MPa	*Yield*	
Modulus of elasticity	E	=	70000	MPa	*Compressive*	
	k_t	=	1			T3.4(B)
	k_c	=	1			
FEM ANALYSIS RESULTS						
Axial force	P	=	1.39	kN	*compression*	
	P	=	0	kN	*Tension*	
In plane moment	M_x	=	6.939E-18	kNm		
Out of plane moment	M_y	=	0.5987	kNm		
DESIGN STRESSES						
Gross cross section area	A_g	=	404	mm^2		
In-plane elastic section modulus	Z_x	=	5955.2741	mm^3		
Out-of-plane elastic section mod.	Z_y	=	6999.2889	mm^3		
Stress from axial force	$\mathbf{f_a}$	=	P/A_g			
		=	**3.44**	**MPa**	*compression*	

		=	**0.00**	**MPa**	*Tension*	
Stress from in-plane bending	f_{bx}	=	M_x/Z_x			
		=	**0.00**	**MPa**	*compression*	
Stress from out-of-plane bending	f_{by}	=	M_y/Z_y			
		=	**85.54**	**MPa**	*compression*	
Tension						
3.4.3 *Tension in rectangular tubes*						
	ϕF_L	**=**	**228.95**	**MPa**		
		OR				
	ϕF_L	**=**	**222.70**	**MPa**		
COMPRESSION						
3.4.8 *Compression in columns, axial, gross section*						
1. General						… 3.4.8.1
Unsupported length of member	L	=	3000	mm		
Effective length factor	k	=	1.00			
Radius of gyration about buckling axis (Y)	r_y	=	22.80	mm		
Radius of gyration about buckling axis (X)	r_x	=	18.21	mm		
Slenderness ratio	kLb/ry	=	131.59			
Slenderness ratio	kL/rx	=	164.73			
Slenderness parameter	λ	=	3.08			
	D_c^*	=	90.3			
	S_1^*	=	0.33			
	S_2^*	=	1.23			
	ϕ_{cc}	=	0.950			
Factored limit state stress	ϕF_L	**=**	**24.19**	**MPa**		
2. Sections not subject to torsional or torsional-flexural buckling						… 3.4.8.2
Largest slenderness ratio for flexural buckling	kL/r	**=**	164.73			
3.4.10 *Uniform compression in components of columns, gross section - flat plates*						
1. Uniform compression in components of columns, gross section - flat plates with both edges supported						… 3.4.10.1
	k_1	**=**	0.35			T3.3(D)
Max. distance between toes of fillets of supporting elements for plate	b'	**=**	56			

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	t	=	2	mm		
Slenderness	b/t	=	28			
Limit 1	S_1	=	12.34			
Limit 2	S_2	=	32.87			
Factored limit state stress	**ϕF_L**	=	**185.00**	**MPa**		
Most adverse compressive limit state stress	F_a	=	24.19	MPa		
Most adverse tensile limit state stress	F_a	=	222.70	MPa		
Most adverse compressive & Tensile capacity factor	f_a/F_a	=	0.14		PASS	
BENDING - IN-PLANE						
3.4.15 *Compression in beams, extreme fibre, gross section rectangular tubes, box sections*						
Unbraced length for bending	L_b	=	3000	mm		
Second moment of area (weak axis)	I_y	=	209978.67	mm^4		
Torsion modulus	J	=	246338.06	mm^3		
Elastic section modulus	Z	=	5955.2741	mm^3		
Slenderness	S	=	157.11			
Limit 1	S_1	=	0.39			
Limit 2	S_2	=	1695.86			
Factored limit state stress	**ϕF_L**	=	**201.63**	**MPa**		... 3.4.15(2)
3.4.17 *Compression in components of beams (component under uniform compression), gross section - flat plates with both edges supported*						
	k_1	=	0.5			T3.3(D)
	k_2	=	2.04			T3.3(D)
Max. distance between toes of fillets of supporting elements for plate	b'	=	56	mm		
	t	=	2	mm		
Slenderness	b/t	=	28			
Limit 1	S_1	=	12.34			
Limit 2	S_2	=	46.95			
Factored limit state stress	**ϕF_L**	=	**185.00**	**MPa**		

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Most adverse in-plane bending limit state stress	F_{bx}	=	185.00	MPa		
Most adverse in-plane bending capacity factor	f_{bx}/F_{bx}	=	0.00		PASS	
BENDING - OUT-OF-PLANE						
NOTE: Limit state stresses, ϕF_L are the same for out-of-plane bending (doubly symmetric section)						
Factored limit state stress	ϕF_L	=	**185.00**	**MPa**		
Most adverse out-of-plane bending limit state stress	F_{by}	=	185.00	MPa		
Most adverse out-of-plane bending capacity factor	f_{by}/F_{by}	=	0.46		PASS	
COMBINED ACTIONS						
***4.1.1** Combined compression and bending*						… 4.1.1(2)
	F_a	=	24.19	MPa		… 3.4.8
	F_{ao}	=	185.00	MPa		… 3.4.10
	F_{bx}	=	185.00	MPa		… 3.4.17
	F_{by}	=	185.00	MPa		… 3.4.17
	f_a/F_a	=	0.142			
Check:	$f_a/F_a + f_{bx}/F_{bx} + f_{by}/F_{by}$	≤	1.0			… 4.1.1 (3)
i.e.	0.60	≤	1.0		PASS	
SHEAR						
***3.4.24** Shear in webs (Major Axis)*						… 4.1.1(2)
Clear web height	h	=	41	mm		
	t	=	2	mm		
Slenderness	h/t	=	20.5			
Limit 1	S_1	=	29.01			
Limit 2	S_2	=	59.31			
Factored limit state stress	ϕF_L	=	**131.10**	**MPa**		
Stress From Shear force	f_{sx}	=	V/A_w			
			0.04	**MPa**		

***3.4.25** Shear in webs (Minor Axis)*

Clear web height	b	=	56	mm		
	t	=	2	mm		
Slenderness	b/t	=	28			
Factored limit state stress	**ϕF_L**	**=**	**131.10**	**MPa**		
Stress From Shear force	**f_{sy}**	**=**	V/A_w			
			1.11	**MPa**		
Most adverseshear capacity factor (Major Axis)	f_{sx}/F_{sx}	=	0.00	**MPa**		
Most adverseshear capacity factor (Minor Axis)	f_{sy}/F_{sy}	**=**	0.01	**Mpa**	PASS	
COMBINED ACTIONS						
***4.4** Combined Shear, Compresion and bending*						
Check:	$f_a/F_a + f_b/F_b + (f_s/F_s)^2 \leq 1.0$					
i.e.	0.60	≤	1.0		PASS	

9.5 Gable Beam

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Job no. 23-573-3 **Date:** 6/07/2023

NAME	SYMBOL		VALUE	UNIT	NOTES	REF
45x60x2	**Gable Beam**					
Alloy and temper	6061-T6					AS1664.1
Tension	F_{tu}	=	262	MPa	*Ultimate*	T3.3(A)
	F_{ty}	=	241	MPa	*Yield*	
Compression	F_{cy}	=	241	MPa		
Shear	F_{su}	=	165	MPa	*Ultimate*	
	F_{sy}	=	138	MPa	*Yield*	
Bearing	F_{bu}	=	551	MPa	*Ultimate*	
	F_{by}	=	386	MPa	*Yield*	

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Modulus of elasticity	E	=	70000	MPa	*Compressive*	
	k_t	=	1			T3.4(B)
	k_c	=	1			
FEM ANALYSIS RESULTS						
Axial force	P	=	3.333	kN	*compression*	
	P	=	0	kN	*Tension*	
In plane moment	M_x	=	0.0989	kNm		
Out of plane moment	M_y	=	0.0007684	kNm		
DESIGN STRESSES						
Gross cross section area	A_g	**=**	404	mm^2		
In-plane elastic section modulus	Z_x	**=**	5955.2741	mm^3		
Out-of-plane elastic section mod.	Z_y	**=**	6999.2889	mm^3		
Stress from axial force	f_a	**=**	P/A_g			
		=	**8.25**	**MPa**	*compression*	
		=	**0.00**	**MPa**	*Tension*	
Stress from in-plane bending	f_{bx}	**=**	M_x/Z_x			
		=	**16.61**	**MPa**	*compression*	
Stress from out-of-plane bending	f_{by}	**=**	M_y/Z_y			
		=	**0.11**	**MPa**	*compression*	
Tension						
***3.4.3** Tension in rectangular tubes*						
	ϕF_L	**=**	**228.95**	**MPa**		
		OR				
	ϕF_L	**=**	**222.70**	**MPa**		
COMPRESSION						
***3.4.8** Compression in columns, axial, gross section*						
1. General						… 3.4.8.1
Unsupported length of member	L	=	3000	mm		
Effective length factor	k	=	1.00			
Radius of gyration about buckling axis (Y)	r_y	=	22.80	mm		
Radius of gyration about buckling axis (X)	r_x	=	18.21	mm		
Slenderness ratio	kLb/ry	=	131.59			

Slenderness ratio	kL/rx	=	164.73			
Slenderness parameter	λ	=	3.08			
	D_c*	=	90.3			
	S_1*	=	0.33			
	S_2*	=	1.23			
	ϕ_{cc}	=	0.950			
Factored limit state stress	**ϕF_L**	**=**	**24.19**	**MPa**		
2. Sections not subject to torsional or torsional-flexural buckling						… 3.4.8.2
Largest slenderness ratio for flexural buckling	kL/r	=	164.73			
***3.4.10** Uniform compression in components of columns, gross section - flat plates*						
1. Uniform compression in components of columns, gross section - flat plates with both edges supported						… 3.4.10.1
	k_1	=	0.35			T3.3(D)
Max. distance between toes of fillets of supporting elements for plate	b'	=	56			
	t	=	2	mm		
Slenderness	b/t	=	28			
Limit 1	S_1	=	12.34			
Limit 2	S_2	=	32.87			
Factored limit state stress	**ϕF_L**	**=**	**185.00**	**MPa**		
Most adverse compressive limit state stress	F_a	=	24.19	MPa		
Most adverse tensile limit state stress	F_a	=	222.70	MPa		
Most adverse compressive & Tensile capacity factor	f_a/F_a	=	0.34		PASS	
BENDING - IN-PLANE						
***3.4.15** Compression in beams, extreme fibre, gross section rectangular tubes, box sections*						
Unbraced length for bending	L_b	=	3000	mm		
Second moment of area (weak axis)	I_y	=	209978.67	mm^4		
Torsion modulus	J	=	246338.06	mm^3		

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Elastic section modulus	Z	=	5955.274 1	mm^3		
Slenderness	S	=	157.11			
Limit 1	S_1	=	0.39			
Limit 2	S_2	=	1695.86			
Factored limit state stress	**ϕF_L**	=	**201.63**	**MPa**		… 3.4.15(2)
3.4.17 *Compression in components of beams (component under uniform compression), gross section - flat plates with both edges supported*						
	k_1	=	0.5			T3.3(D)
	k_2	=	2.04			T3.3(D)
Max. distance between toes of fillets of supporting elements for plate	b'	=	56	mm		
	t	=	2	mm		
Slenderness	b/t	=	28			
Limit 1	S_1	=	12.34			
Limit 2	S_2	=	46.95			
Factored limit state stress	**ϕF_L**	=	**185.00**	**MPa**		
Most adverse in-plane bending limit state stress	F_{bx}	=	185.00	MPa		
Most adverse in-plane bending capacity factor	f_{bx}/F_{bx}	=	0.09		PASS	
BENDING - OUT-OF-PLANE						
NOTE: Limit state stresses, ϕF_L are the same for out-of-plane bending (doubly symmetric section)						
Factored limit state stress	**ϕF_L**	=	**185.00**	**MPa**		
Most adverse out-of-plane bending limit state stress	**F_{by}**	=	185.00	MPa		
Most adverse out-of-plane bending capacity factor	**f_{by}/F_{by}**	=	0.00		PASS	
COMBINED ACTIONS						
4.1.1 *Combined compression and bending*						… 4.1.1(2)
	F_a	=	24.19	MPa		… 3.4.8

	F_{ao}	=	185.00	MPa		… 3.4.10
	F_{bx}	=	185.00	MPa		… 3.4.17
	F_{by}	=	185.00	MPa		… 3.4.17
	f_a/F_a	=	0.341			
Check:	$f_a/F_a + f_{bx}/F_{bx} + f_{by}/F_{by} \leq 1.0$					… 4.1.1 (3)
i.e.	0.43	≤	1.0		PASS	
SHEAR						
***3.4.24** Shear in webs (Major Axis)*						… 4.1.1(2)
Clear web height	h	=	41	mm		
	t	=	2	mm		
Slenderness	h/t	=	20.5			
Limit 1	S_1	=	29.01			
Limit 2	S_2	=	59.31			
Factored limit state stress	**ϕF_L**	=	**131.10**	**MPa**		
Stress From Shear force	**f_{sx}**	=	V/A_w			
			0.14	**MPa**		
***3.4.25** Shear in webs (Minor Axis)*						
Clear web height	b	=	56	mm		
	t	=	2	mm		
Slenderness	b/t	=	28			
Factored limit state stress	**ϕF_L**	=	**131.10**	**MPa**		
Stress From Shear force	**f_{sy}**	=	V/A_w			
			0.04	**MPa**		
Most adverseshear capacity factor (Major Axis)	f_{sx}/F_{sx}	=	0.00	**MPa**		
Most adverseshear capacity factor (Minor Axis)	f_{sy}/F_{sy}	=	0.00	**Mpa**	PASS	
COMBINED ACTIONS						
***4.4** Combined Shear, Compresion and bending*						
Check:	$f_a/F_a + f_b/F_b + (f_s/F_s)^2 \leq 1.0$					
i.e.	0.43	≤	1.0		PASS	

9.6 Intermediate Purlin

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Job no. 23-573-3 **Date:** 6/07/2023

NAME	SYMBOL		VALUE	UNIT	NOTES	REF
40x40x2	**Intermediate Purlin**					
Alloy and temper	6061-T6					AS1664.1
Tension	F_{tu}	=	262	MPa	*Ultimate*	T3.3(A)
	F_{ty}	=	241	MPa	*Yield*	
Compression	F_{cy}	=	241	MPa		
Shear	F_{su}	=	165	MPa	*Ultimate*	
	F_{sy}	=	138	MPa	*Yield*	
Bearing	F_{bu}	=	551	MPa	*Ultimate*	
	F_{by}	=	386	MPa	*Yield*	
Modulus of elasticity	E	=	70000	MPa	*Compressive*	
	k_t	=	1			T3.4(B)
	k_c	=	1			
FEM ANALYSIS RESULTS						
Axial force	P	=	0.333	kN	*compression*	
	P	=	0	kN	*Tension*	
In plane moment	M_x	=	0.4891	kNm		
Out of plane moment	M_y	=	0.0189	kNm		
DESIGN STRESSES						
Gross cross section area	A_g	**=**	304	mm^2		
In-plane elastic section modulus	Z_x	**=**	3668.2667	mm^3		
Out-of-plane elastic section mod.	Z_y	**=**	3668.2667	mm^3		
Stress from axial force	$\mathbf{f_a}$	**=**	P/A_g			
		=	**1.10**	**MPa**	*compression*	
		=	**0.00**	**MPa**	*Tension*	
Stress from in-plane bending	$\mathbf{f_{bx}}$	**=**	M_x/Z_x			
		=	**133.33**	**MPa**	*compression*	

Stress from out-of-plane bending	**f_{by}**	=	M_y/Z_y			
		=	**5.15**	**MPa**	*compression*	
Tension						
***3.4.3** Tension in rectangular tubes*						
	ϕF_L	**=**	**228.95**	**MPa**		
		OR				
	ϕF_L	**=**	**222.70**	**MPa**		
COMPRESSION						
***3.4.8** Compression in columns, axial, gross section*						
1. General						… 3.4.8.1
Unsupported length of member	L	=	3000	mm		
Effective length factor	k	=	1.00			
Radius of gyration about buckling axis (Y)	r_y	=	15.53	mm		
Radius of gyration about buckling axis (X)	r_x	=	15.53	mm		
Slenderness ratio	kLb/ry	=	193.11			
Slenderness ratio	kL/rx	=	193.11			
Slenderness parameter	λ	=	3.61			
	D_c*	=	90.3			
	S_1*	=	0.33			
	S_2*	=	1.23			
	ϕ_{cc}	=	0.950			
Factored limit state stress	**ϕF_L**	**=**	**17.60**	**MPa**		
2. Sections not subject to torsional or torsional-flexural buckling						… 3.4.8.2
Largest slenderness ratio for flexural buckling	kL/r	**=**	193.11			
***3.4.10** Uniform compression in components of columns, gross section - flat plates*						
1. Uniform compression in components of columns, gross section - flat plates with both edges supported						… 3.4.10.1
	k_1	**=**	0.35			T3.3(D)
Max. distance between toes of fillets of supporting elements for plate	b'	**=**	36			
	t	**=**	2	mm		
Slenderness	b/t	**=**	18			
Limit 1	S_1	**=**	12.34			

Limit 2	S_2	=	32.87			
Factored limit state stress	**ϕF_L**	=	**213.07**	**MPa**		
Most adverse compressive limit state stress	F_a	=	17.60	MPa		
Most adverse tensile limit state stress	F_a	=	222.70	MPa		
Most adverse compressive & Tensile capacity factor	f_a/F_a	=	0.06		PASS	
BENDING - IN-PLANE						
***3.4.15** Compression in beams, extreme fibre, gross section rectangular tubes, box sections*						
Unbraced length for bending	L_b	=	3000	mm		
Second moment of area (weak axis)	I_y	=	73365.333	mm^4		
Torsion modulus	J	=	109744	mm^3		
Elastic section modulus	Z	=	3668.2667	mm^3		
Slenderness	S	=	245.29			
Limit 1	S_1	=	0.39			
Limit 2	S_2	=	1695.86			
Factored limit state stress	**ϕF_L**	=	**194.46**	**MPa**		... 3.4.15(2)
***3.4.17** Compression in components of beams (component under uniform compression), gross section - flat plates with both edges supported*						
	k_1	=	0.5			T3.3(D)
	k_2	=	2.04			T3.3(D)
Max. distance between toes of fillets of supporting elements for plate	b'	=	36	mm		
	t	=	2	mm		
Slenderness	b/t	=	18			
Limit 1	S_1	=	12.34			
Limit 2	S_2	=	46.95			
Factored limit state stress	**ϕF_L**	=	**213.07**	**MPa**		
Most adverse in-plane bending limit state stress	F_{bx}	=	194.46	MPa		

Most adverse in-plane bending capacity factor	f_{bx}/F_{bx}	=	0.69		PASS	
BENDING - OUT-OF-PLANE						
NOTE: Limit state stresses, ϕF_L are the same for out-of-plane bending (doubly symmetric section)						
Factored limit state stress	$\boldsymbol{\phi F_L}$	=	**194.46**	**MPa**		
Most adverse out-of-plane bending limit state stress	$\boldsymbol{F_{by}}$	=	194.46	MPa		
Most adverse out-of-plane bending capacity factor	$\boldsymbol{f_{by}/F_{by}}$	=	0.03		PASS	
COMBINED ACTIONS						
***4.1.1** Combined compression and bending*						… 4.1.1(2)
	F_a	=	17.60	MPa		… 3.4.8
	F_{ao}	=	213.07	MPa		… 3.4.10
	F_{bx}	=	194.46	MPa		… 3.4.17
	F_{by}	=	194.46	MPa		… 3.4.17
	f_a/F_a	=	0.062			
Check:	$f_a/F_a + f_{bx}/F_{bx} + f_{by}/F_{by} \leq 1.0$					… 4.1.1 (3)
i.e.	0.77	≤	1.0		PASS	
SHEAR						
***3.4.24** Shear in webs (Major Axis)*						… 4.1.1(2)
Clear web height	h	=	36	mm		
	t	=	2	mm		
Slenderness	h/t	=	18			
Limit 1	S_1	=	29.01			
Limit 2	S_2	=	59.31			
Factored limit state stress	$\boldsymbol{\phi F_L}$	=	**131.10**	**MPa**		
Stress From Shear force	$\boldsymbol{f_{sx}}$	=	V/A_w			
			0.00	**MPa**		
***3.4.25** Shear in webs (Minor Axis)*						
Clear web height	b	=	36	mm		

	t	=	2	mm		
Slenderness	b/t	=	18			
Factored limit state stress	**ϕF_L**	=	**131.10**	**MPa**		
Stress From Shear force	**f_{sy}**	=	V/A_w			
			0.06	**MPa**		
Most adverseshear capacity factor (Major Axis)	f_{sx}/F_{sx}	=	0.00	**MPa**		
Most adverseshear capacity factor (Minor Axis)	f_{sy}/F_{sy}	=	0.00	**Mpa**	PASS	
COMBINED ACTIONS						
***4.4** Combined Shear, Compresion and bending*						
Check:	$f_a/F_a + f_b/F_b + (f_s/F_s)^2 \leq 1.0$					
i.e.	0.75	≤	1.0		PASS	

9.7 Brace

Job no. 23-573-3 **Date:** 6/07/2023

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NAME	SYMBOL		VALUE	UNIT	NOTES	REF
40x40x2	**Brace**					
Alloy and temper	6061-T6					AS1664.1
Tension	F_{tu}	=	262	MPa	*Ultimate*	T3.3(A)
	F_{ty}	=	241	MPa	*Yield*	
Compression	F_{cy}	=	241	MPa		
Shear	F_{su}	=	165	MPa	*Ultimate*	
	F_{sy}	=	138	MPa	*Yield*	
Bearing	F_{bu}	=	551	MPa	*Ultimate*	
	F_{by}	=	386	MPa	*Yield*	
Modulus of elasticity	E	=	70000	MPa	*Compressive*	

	k_t	=	1			T3.4(B)
	k_c	=	1			
FEM ANALYSIS RESULTS						
Axial force	P	=	1.903	kN	*compression*	
	P	=	0	kN	*Tension*	
In plane moment	M_x	=	6.939E-18	kNm		
Out of plane moment	M_y	=	0.0288	kNm		
DESIGN STRESSES						
Gross cross section area	A_g	**=**	304	mm^2		
In-plane elastic section modulus	Z_x	**=**	3668.2667	mm^3		
Out-of-plane elastic section mod.	Z_y	**=**	3668.2667	mm^3		
Stress from axial force	f_a	**=**	P/A_g			
		=	**6.26**	**MPa**	*compression*	
		=	**0.00**	**MPa**	*Tension*	
Stress from in-plane bending	f_{bx}	**=**	M_x/Z_x			
		=	**0.00**	**MPa**	*compression*	
Stress from out-of-plane bending	f_{by}	**=**	M_y/Z_y			
		=	**7.85**	**MPa**	*compression*	
Tension						
***3.4.3** Tension in rectangular tubes*						
	ϕF_L	**=**	**228.95**	**MPa**		
		OR				
	ϕF_L	**=**	**222.70**	**MPa**		
COMPRESSION						
***3.4.8** Compression in columns, axial, gross section*						
1. General						… 3.4.8.1
Unsupported length of member	L	=	4000	mm		
Effective length factor	k	=	1.00			
Radius of gyration about buckling axis (Y)	r_y	=	15.53	mm		
Radius of gyration about buckling axis (X)	r_x	=	15.53	mm		
Slenderness ratio	kLb/ry	=	257.48			
Slenderness ratio	kL/rx	=	257.48			
Slenderness parameter	λ	=	4.81			
	D_c^*	=	90.3			

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	S_1*	=	0.33			
	S_2*	=	1.23			
	ϕ_{cc}	=	0.950			
Factored limit state stress	**ϕF_L**	=	**9.90**	**MPa**		
2. Sections not subject to torsional or torsional-flexural buckling						… 3.4.8.2
Largest slenderness ratio for flexural buckling	kL/r	=	257.48			
***3.4.10** Uniform compression in components of columns, gross section - flat plates*						
1. Uniform compression in components of columns, gross section - flat plates with both edges supported						… 3.4.10.1
	k_1	=	0.35			T3.3(D)
Max. distance between toes of fillets of supporting elements for plate	b'	=	36			
	t	=	2	mm		
Slenderness	b/t	=	18			
Limit 1	S_1	=	12.34			
Limit 2	S_2	=	32.87			
Factored limit state stress	**ϕF_L**	=	**213.07**	**MPa**		
Most adverse compressive limit state stress	F_a	=	9.90	MPa		
Most adverse tensile limit state stress	F_a	=	222.70	MPa		
Most adverse compressive & Tensile capacity factor	f_a/F_a	=	0.63		PASS	
BENDING - IN-PLANE						
***3.4.15** Compression in beams, extreme fibre, gross section rectangular tubes, box sections*						
Unbraced length for bending	L_b	=	4000	mm		
Second moment of area (weak axis)	I_y	=	73365.333	mm^4		
Torsion modulus	J	=	109744	mm^3		
Elastic section modulus	Z	=	3668.2667	mm^3		
Slenderness	S	=	327.05			
Limit 1	S_1	=	0.39			

Limit 2	S_2	=	1695.86			
Factored limit state stress	**ϕF_L**	=	**188.90**	**MPa**		… 3.4.15(2)
3.4.17 *Compression in components of beams (component under uniform compression), gross section - flat plates with both edges supported*						
	k_1	=	0.5			T3.3(D)
	k_2	=	2.04			T3.3(D)
Max. distance between toes of fillets of supporting elements for plate	b'	=	36	mm		
	t	=	2	mm		
Slenderness	b/t	=	18			
Limit 1	S_1	=	12.34			
Limit 2	S_2	=	46.95			
Factored limit state stress	**ϕF_L**	=	**213.07**	**MPa**		
Most adverse in-plane bending limit state stress	F_{bx}	=	188.90	MPa		
Most adverse in-plane bending capacity factor	f_{bx}/F_{bx}	=	0.00		PASS	
BENDING - OUT-OF-PLANE						
NOTE: Limit state stresses, ϕF_L are the same for out-of-plane bending (doubly symmetric section)						
Factored limit state stress	**ϕF_L**	=	**188.90**	**MPa**		
Most adverse out-of-plane bending limit state stress	**F_{by}**	=	188.90	MPa		
Most adverse out-of-plane bending capacity factor	**f_{by}/F_{by}**	=	0.04		PASS	
COMBINED ACTIONS						
4.1.1 *Combined compression and bending*						… 4.1.1(2)
	F_a	=	9.90	MPa		… 3.4.8
	F_{ao}	=	213.07	MPa		… 3.4.10
	F_{bx}	=	188.90	MPa		… 3.4.17
	F_{by}	=	188.90	MPa		… 3.4.17

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	f_a/F_a	=	0.632			
Check:	$f_a/F_a + f_{bx}/F_{bx} + f_{by}/F_{by} \leq 1.0$					… 4.1.1 (3)
i.e.	0.67	≤	1.0		PASS	
SHEAR						
3.4.24 *Shear in webs (Major Axis)*						… 4.1.1(2)
Clear web height	h	=	36	mm		
	t	=	2	mm		
Slenderness	h/t	=	18			
Limit 1	S_1	=	29.01			
Limit 2	S_2	=	59.31			
Factored limit state stress	ϕF_L	=	**131.10**	**MPa**		
Stress From Shear force	f_{sx}	=	V/A_w			
			0.04	**MPa**		
3.4.25 *Shear in webs (Minor Axis)*						
Clear web height	b	=	36	mm		
	t	=	2	mm		
Slenderness	b/t	=	18			
Factored limit state stress	ϕF_L	=	**131.10**	**MPa**		
Stress From Shear force	f_{sy}	=	V/A_w			
			0.04	**MPa**		
Most adverseshear capacity factor (Major Axis)	f_{sx}/F_{sx}	=	0.00	**MPa**		
Most adverseshear capacity factor (Minor Axis)	f_{sy}/F_{sy}	=	0.00	**Mpa**	PASS	
COMBINED ACTIONS						
4.4 *Combined Shear, Compresion and bending*						
Check:	$f_a/F_a + f_b/F_b + (f_s/F_s)^2 \leq 1.0$					
i.e.	0.67	≤	1.0		PASS	