Prime Consulting Engineers Pty. Ltd.

Design Report:

5m X 10m Inflatable Marquee

For

EXTREME MARQUEES

Ref: R-22-253-2

Date: 01/07/2022

Amendment: -

Prepared by: KZ

Checked by: BG

CONTENTS

1 Introduction and Scope: 3
1.1 Project Description 3
1.2 References 3
1.3 Notation 3
2 Design Overview 4
2.1 Geometry Data 4
2.2 Assumptions & Limitations 5
2.3 Exclusions 5
2.4 Design Parameters and Inputs 5
2.4.1 Load Cases 5
2.4.2 Load Combinations 5
3 Design Loads 6
4 Wind Analysis 7
4.1 Ultimate 7
4.1.1 Summary Forces 13
5 Load Diagrams 14
5.1 Wind Load 14
5.1.1 Wind Direction 1 (min) 14
5.1.2 Wind Direction 1 (max) 15
5.1.3 Wind Direction 2 (min) 16
5.1.4 Wind Direction 2 (max) 17
5.1.5 Wind Load Internal Suction ($W_{I,suction}$) 18
5.1.6 Wind Load Internal Suction ($W_{I,pressure}$) 19
6 Analysis 20
6.1 3D model 20
6.2 Results 21
6.2.1 Maximum Reactions 21
7 Holding Down Requirements 22
8 Summary and Recommendations 23
9 Appendix A – Detail Drawings 24

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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 wind analysis on 5m X 10m Inflatable marquee for various wind speeds (region A, non-cyclonic). 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 (Section 1.2)

1.1 Project Description

The report examines the effect of 3s gust wind of various wind speeds **(refer to summary)** positioned for the worst effect on the 5m X 10m Marque structure to determine holding down weight requirements. The relevant Australian Standards AS1170.0:2002 General principles, AS1170.1:2002 Permanent, imposed and other actions and AS1170.2:2021 Wind are used.

1.2 References

- The documents referred to in this report are as follows:
  - Report of results produced through SAP2000 V24 software & excel spreadsheets.
  - Detail drawing provided by manufacturer. Refer to appendix 'A'.
- 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)
- 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

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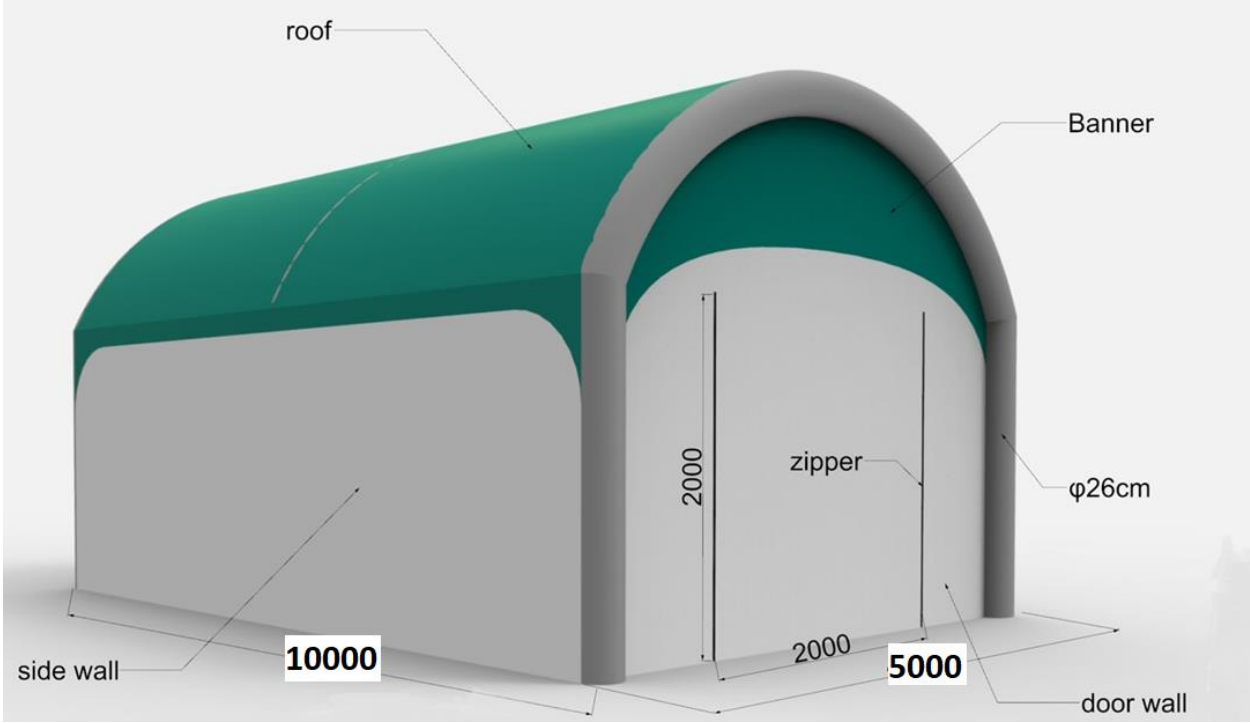
2 Design Overview

2.1 Geometry Data



Isometric view of structures

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2.2 Assumptions & Limitations

- The erected structure is for temporary use only.
- For forecast winds in excess of **(refer to summary)** the inflatable structure should be completely deflated.
- The structure may only be used in regions with classifications no greater than the limits specified in cl. 4 of this report.
- Parameters used for wind & snow calculations:
    - TC 2
    - Wind Region A
- Topographical factors such as erecting the structure on the crest of a hill or on the top of an escarpment may result in a higher wind speed classification. Thus, special considerations should be taken to the topographical location of the installation site.
- 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.
- It is assumed that the structure is fully enclosed with equally permeable side walls or completely sealed walls to calculate Wind Internal Forces.
- The structure has the total self-weight of 60kg.

2.3 Exclusions

- Design of PVC members & fabric
- Wind actions due to tropical or severe tropical cyclonic areas.
- Snow actions
- Super imposed loads such as live load.

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)

2.4.2 Load Combinations

Strength (ULS):

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1. 1.35G Permanent action only
2. 0.9G+W_u Permanent and wind actions
3. 1.2G+W_u Permanent and wind actions
4. 1.2G+W_u+W_{IS} Permanent and wind actions
5. 0.9G+W_u+W_{IP} Permanent and wind actions

Serviceability (SLS):

1. G+W_s Wind service actions

3 Design Loads

Self weight	G	self weight
3s 80km/hr gust	W_u	0.242 C_{fig} (kPa)

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4 Wind Analysis

4.1 Ultimate

PRIME CONSULTING ENGINEERS PTY. LTD

Project: *5m x 10m inflatable Tent*

Jon no. *22-253-2* *Designer:* *KZ*

Date: *01/07/2022* *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	22.222	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	$V_{Site,\beta}=V_R*M_d*M_{z,cat}*M_S,M_t$	
Width	B	5	m		
Width Span	S_w	5	m		
Length	D	10	m		
Height	Z	2.9	m		
Bay Span		5	m		
	h/d	0.29			
	h/b	0.58			
		Wind Pressure			
ρair	ρ	1.2	Kg/m^3		
dynamic response factor	C_{dyn}	1			
Wind Pressure	$\rho*C_{fig}$	**0.245**	Kg/m^2	$\rho=0.5\rho_{air}*(V_{des,\beta})^2*C_{fig}*C_{dyn}$	*2.4 (AS1170.2)*

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WIND DIRECTION 1 (Perpendicular to Length)					
Internal Pressure					
Opening Assumption		***Without Dominant Opening***			
Internal Pressure Coefficient (Without Dominant) **MIN**		-0.3			
Internal Pressure Coefficient (Without Dominant) **MAX**		0.2			
Internal Pressure Coefficient (With Dominant) **MIN**		0			
Internal Pressure Coefficient (With Dominant) **MAX**		0			
N		0		*Cpi= N*Cpe*	
Combination Factor	$K_{C,i}$	1			
Internal Pressure Coefficient **MIN**	$C_{p,i}$	-0.30			
Internal Pressure Coefficient **MAX**	$C_{p,i}$	0.20			
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	**0.34**	**kN/m**		
Intermediate Column Force	F	**0.69**	**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			

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Leeward Wall Pressure	P	**-0.10**	**kPa**		
Edge Column Force	F	**-0.25**	**kN/m**		
Intermediate Column Force	F	**-0.49**	**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					
r (rise)	r	1.8	**m**		
h/r	h/r	1.61			
Breadth Effect		1.19		*(b/d)^0.25>1*	
Rise-to-span ratio	r/d	0.18			
4.1 Roof Windward Quarter					
U	U	1.25	**m**		Table C3
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	$C_{P,e}$	-0.34			
Factored External Pressure Coefficient	$C_{P,e}$	-0.40			
aerodynamic shape factor	$C_{fig,e}$	-0.32			

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Pressure	P	**-0.08**	**kPa**		
4.2 Roof Centre Half					
T	T	2.5	**m**		Table C3
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	$C_{P,e}$	-0.87			
Factored External Pressure Coefficient	$C_{P,e}$	-1.04			
aerodynamic shape factor	$C_{fig,e}$	-0.83			
Pressure	P	**-0.20**	**kPa**		
4.2 Roof Centre Half					
D	D	1.25	**m**		Table C3
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	$C_{P,e}$	-0.57			
Factored External Pressure Coefficient	$C_{P,e}$	-0.68			
aerodynamic shape factor	$C_{fig,e}$	-0.54			
Pressure	P	**-0.13**	**kPa**		
WIND DIRECTION 2 (Parallel to Length)					
Internal Pressure					
Opening Assumption		***Without Dominant Opening***			
Internal Pressure Coefficient (Without Dominant) **MIN**		-0.3			
Internal Pressure Coefficient (Without Dominant) **MAX**		0.2			
Internal Pressure Coefficient (With Dominant) **MIN**					
Internal Pressure Coefficient (With Dominant) **MAX**					

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N				*Cpi= N*Cpe*	
Combination Factor	$K_{C,i}$	1			
Internal Pressure Coefficient **MIN**	$C_{p,i}$	-0.30			
Internal Pressure Coefficient **MAX**	$C_{p,i}$	0.20			
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	**0.34**	**kN/m**		
Intermediate Column Force	F	**0.69**	**kN/m**		
2. Leeward Wall					
External Pressure Coefficient	$C_{P,e}$	-0.3			
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	$C_{fig,e}$	-0.24			
Lee Wall Pressure	P	**-0.06**	**kPa**		
Edge Column Force	F	**-0.60**	**kN/m**		
Intermediate Column Force	F	**-1.20**	**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*	

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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**	
Side Wall Pressure	**P**	**-0.04**	**kPa**	
4. Roof				α *<10°*
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*

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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*	

4.1.1 Summary Forces

WIND EXTERNAL PRESSURE						
			Wind Direction1 (Perpendicular to Length)	Wind Direction2 (Parallel to Length)		
Windward			0.14	0.14		
Leeward			-0.10	-0.06		
Sidewall	0m - 2.9m		-0.13	-0.13		
	2.9m - 5.8m		-0.10	-0.10		
	5.8m - 8.7m		-0.06	-0.06		
	> 8.7m		-0.04	-0.04		
Roof				0m - 1.45m	-0.18	-0.08
	Windward Quarter (U)	1.25m	-0.08	1.45m - 2.9m	-0.18	-0.08
	Centre Half (T)	2.5m	-0.20	2.9m - 5.8m	-0.10	0.00
	Leeward Quarter (D)	1.25m	-0.13	5.8m - 8.7m	-0.06	0.02
				>8.7m	-0.04	0.04
Wind Internal Pressure (kPa)						
			-0.07 0.05	-0.07		0.05

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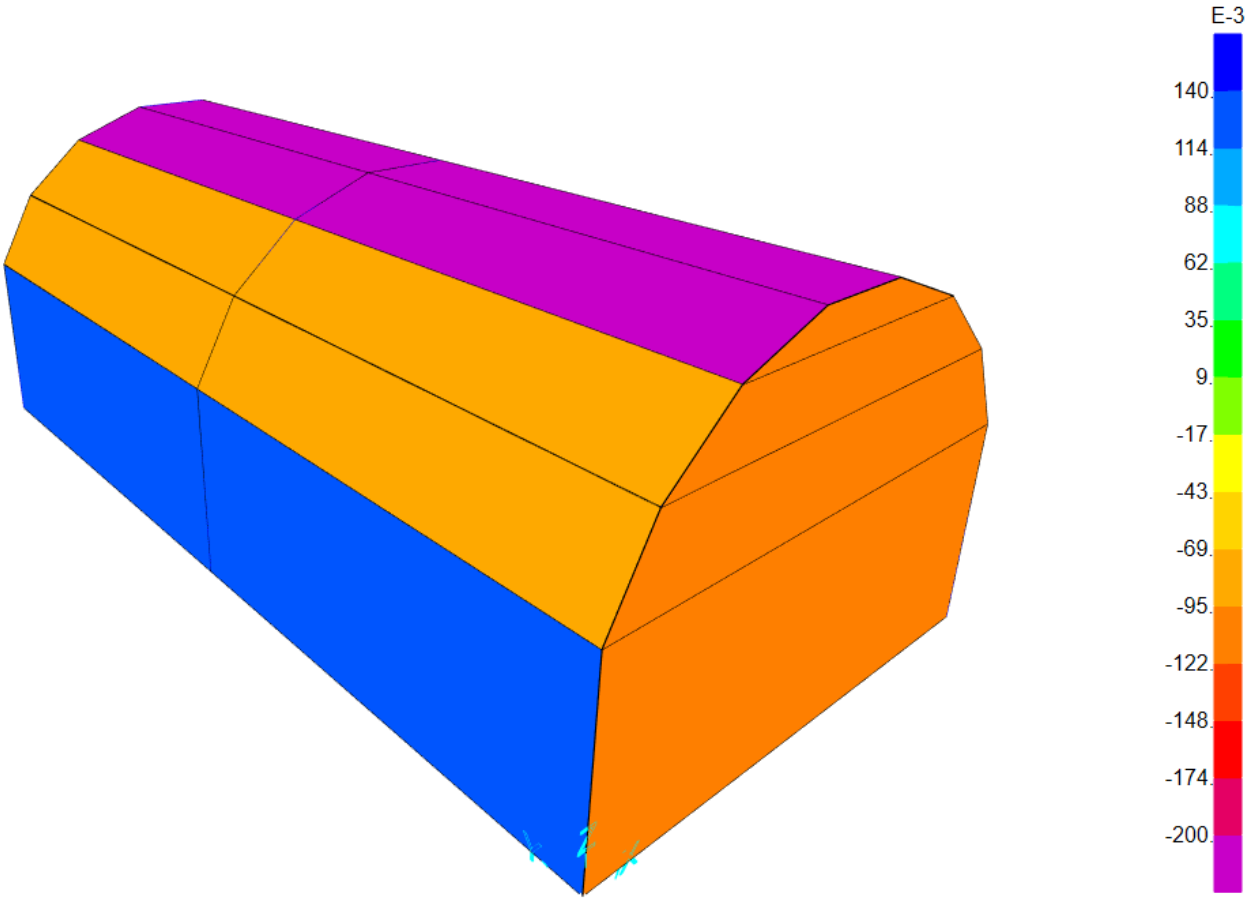
5 Load Diagrams

5.1 Wind Load

5.1.1 Wind Direction 1 (min)



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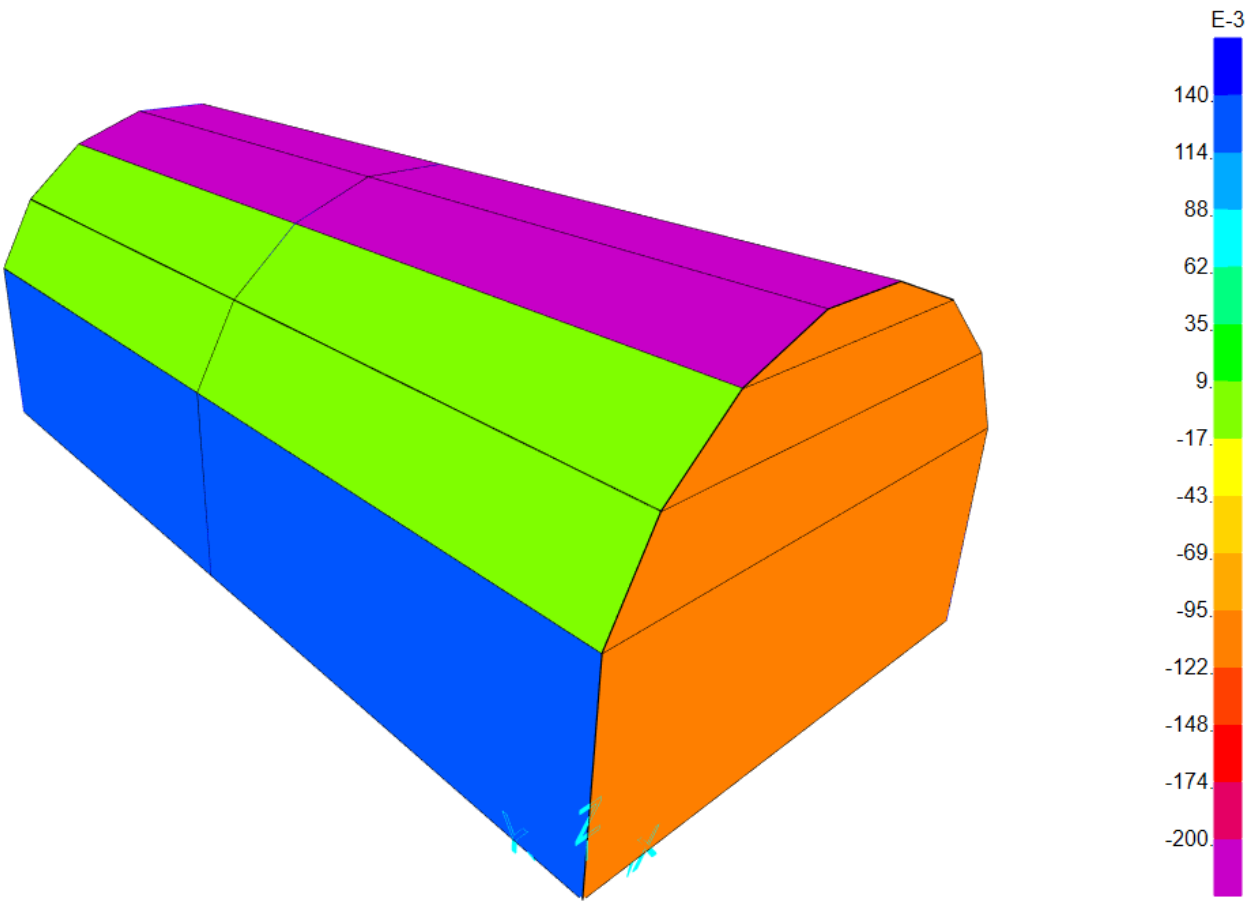
5.1.2 Wind Direction 1 (max)



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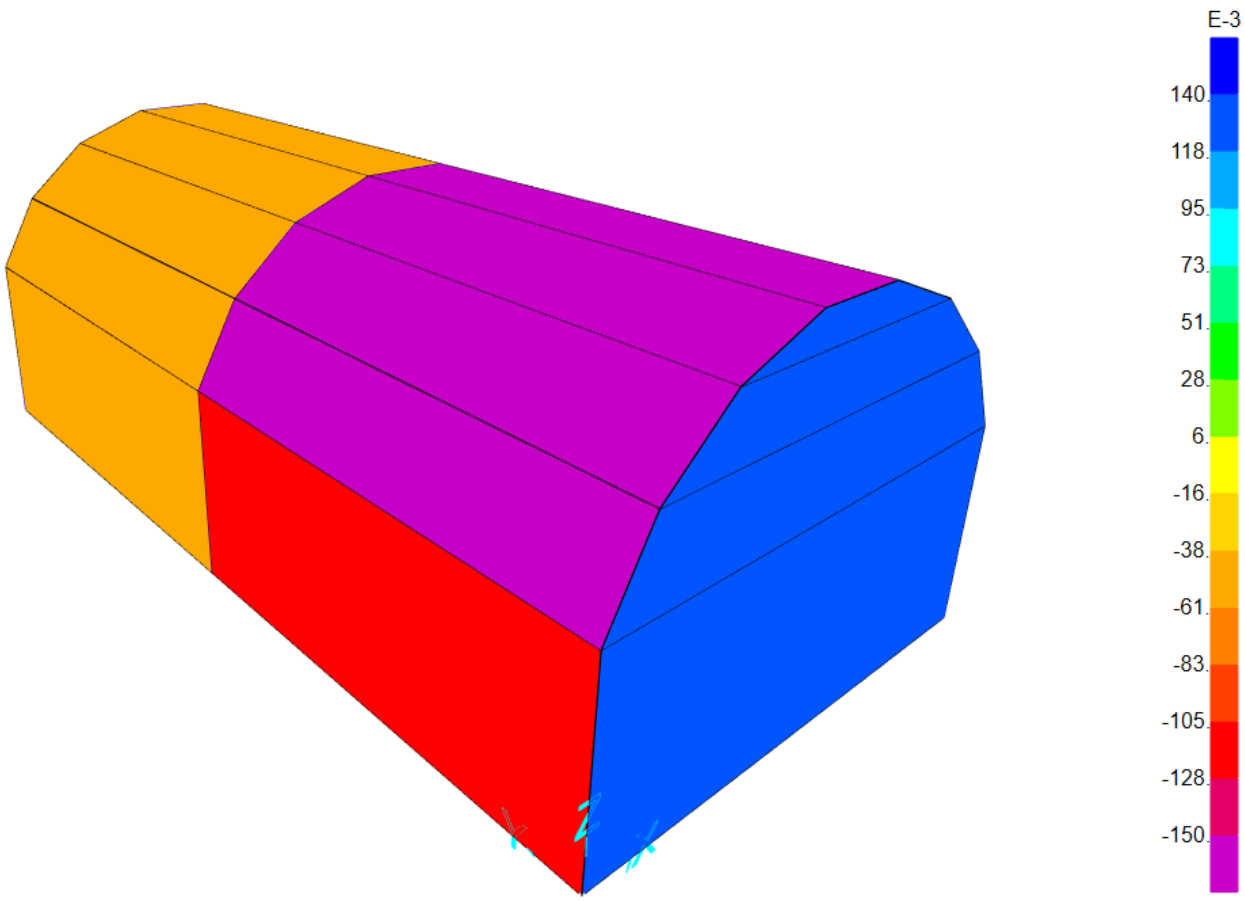
5.1.3 Wind Direction 2 (min)



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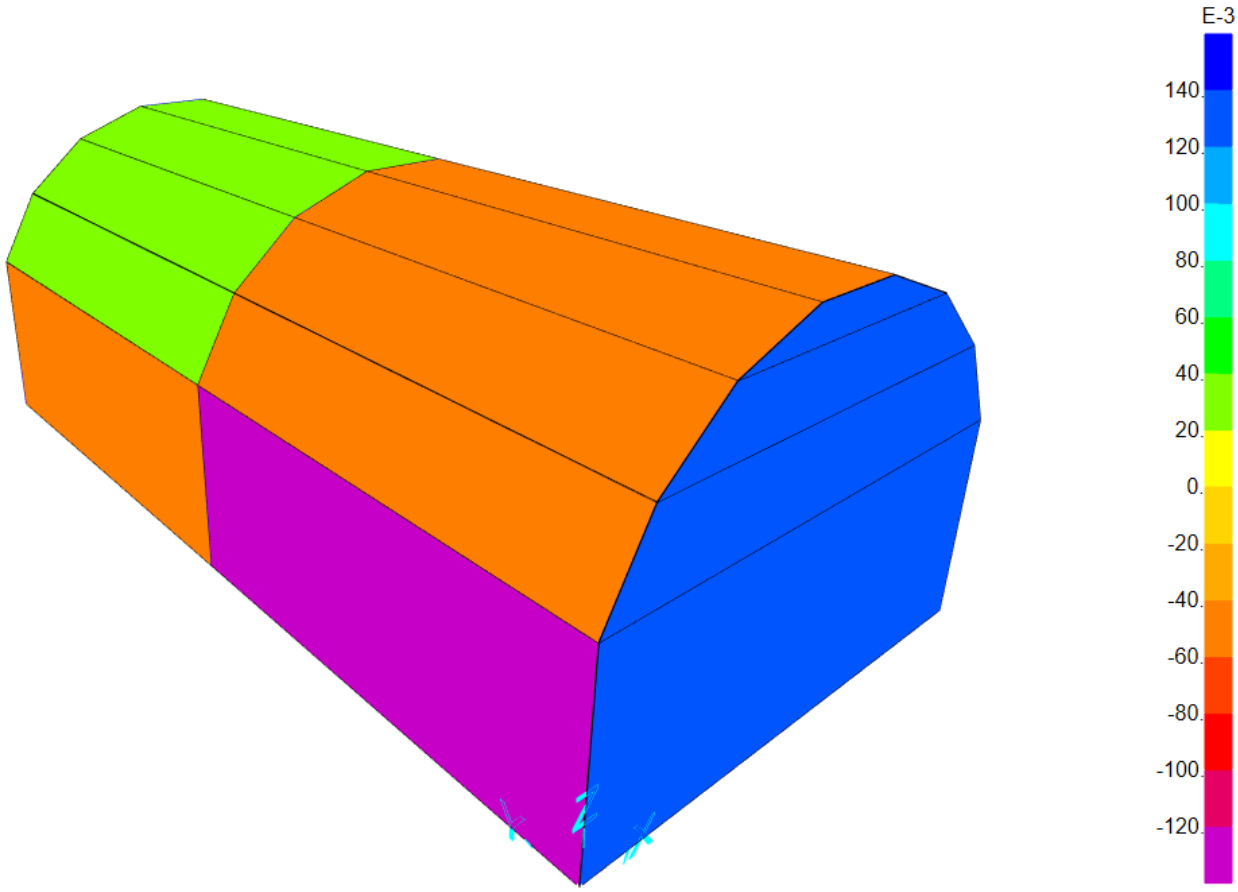
5.1.4 Wind Direction 2 (max)



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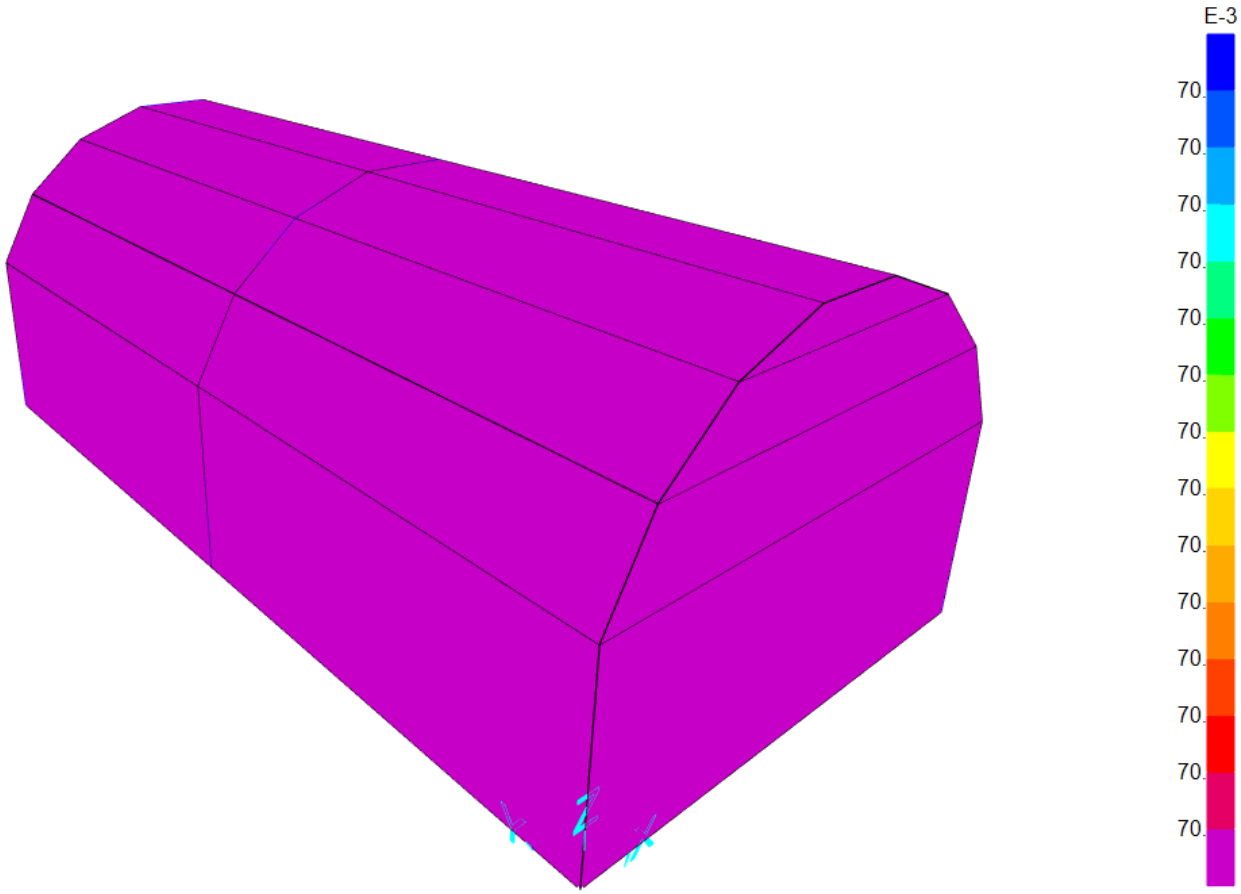
5.1.5 Wind Load Internal Suction ($W_{I,suction}$)



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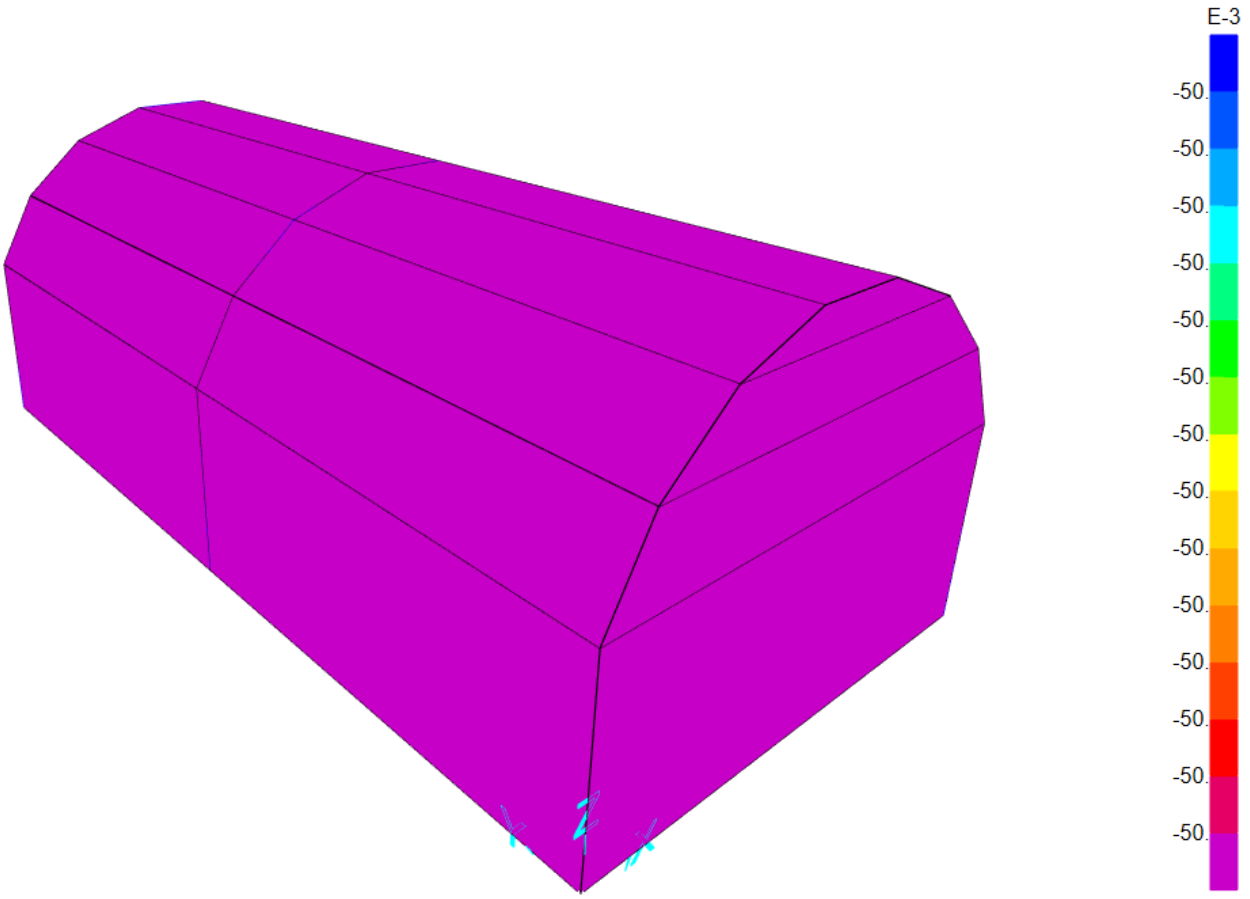
5.1.6 Wind Load Internal Suction ($W_{I,pressure}$)



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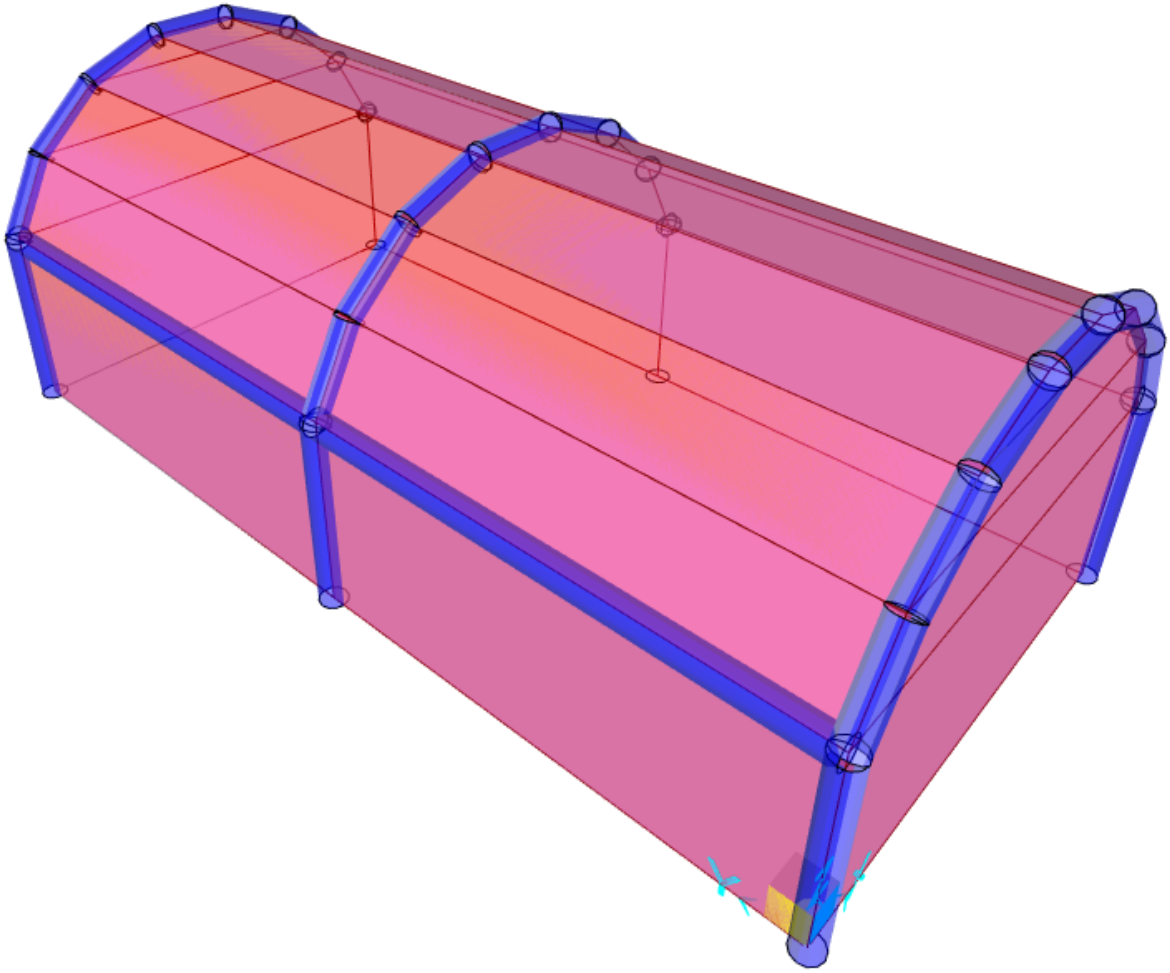
6 Analysis

6.1 3D model



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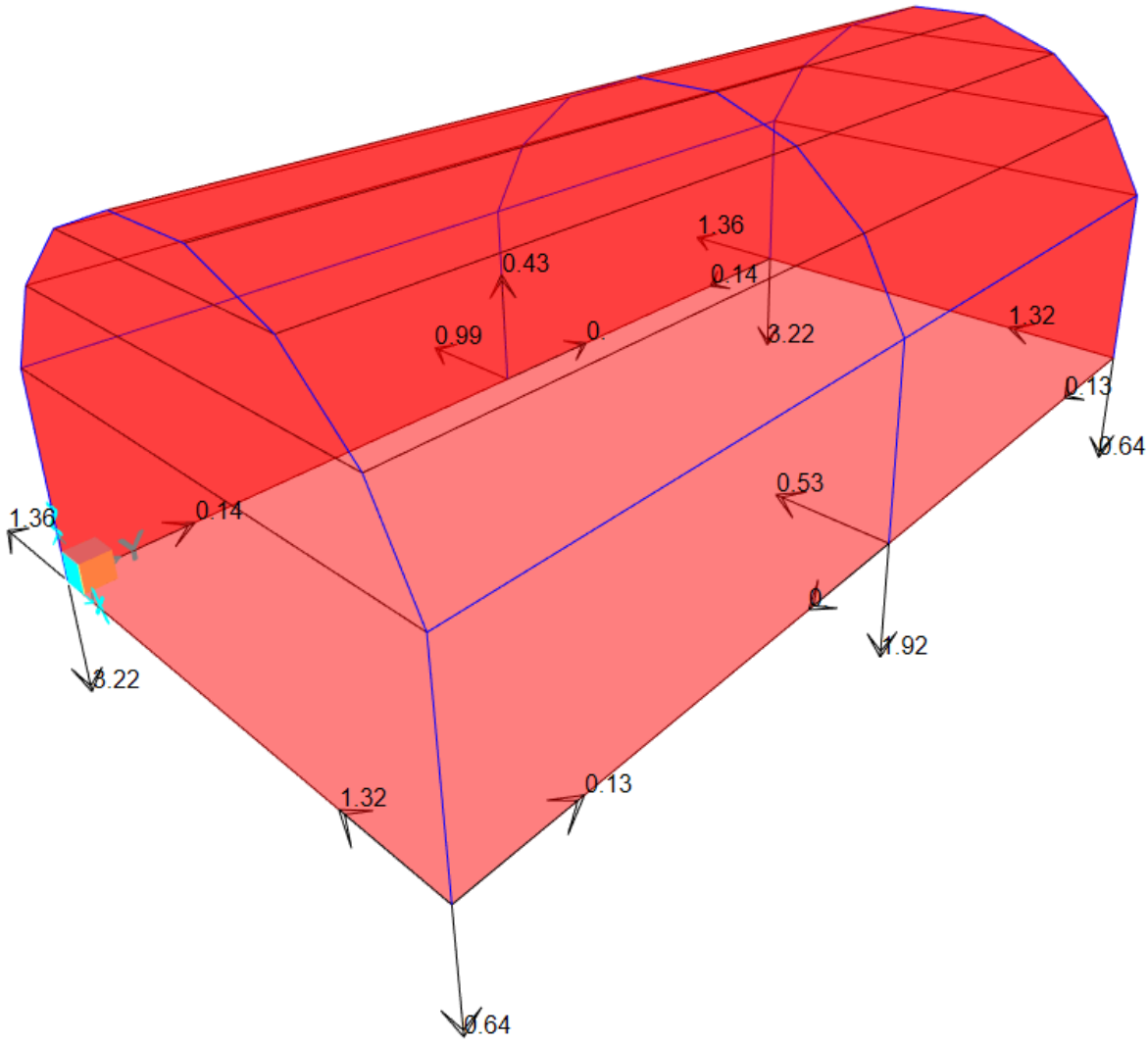
6.2 Results

6.2.1 Maximum Reactions



Max. F_x = 1.35 kN
Max. F_y = 0.95 kN
Max. $F_{Z,\ Bearing}$ = 2.22 kN
Max. $F_{Z,\ uplift}$ = 3.22 kN

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7 Holding Down Requirements

Refer table below for holding down weight requirements for various wind speeds

Wind Speed (km/hr)	Wind Speed (m/s)	Weight Per leg (kg)	Total Weigh (kg)
80	22.22	330	1980
60	16.67	190	1140
40	11.11	110	660

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8 Summary and Recommendations

- The 5m x 10m Inflatable Marquee is required to be deflated for forecast winds in excess of 80, 60 & 40km/hr based on provided weights per leg as per Cl.7.
- For uplift due to 80, 60 & 40km/hr wind speeds, holding down weight per leg is required as tabulated in Cl. 7 and shown below.
- Design of fabric is by others.

Wind Speed (km/hr)	Wind Speed (m/s)	Weight Per leg (kg)	Total Weigh (kg)
80	22.22	330	1980
60	16.67	190	1140
40	11.11	110	660

Yours faithfully,

Prime Consulting Engineers Pty. Ltd.

Kevin Zia, BEng, Meng, MIEAust, CPENG NER

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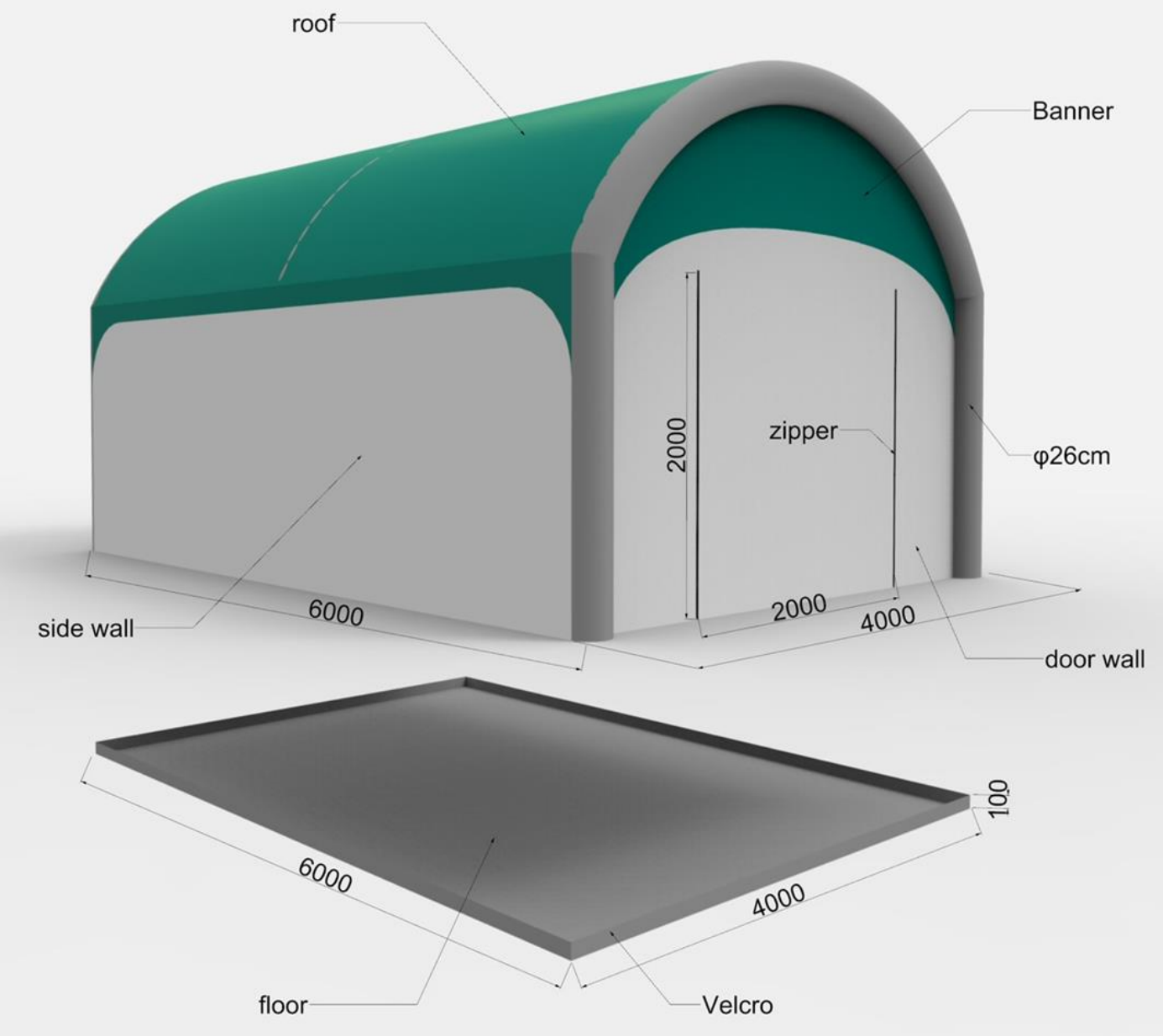
9 Appendix A – Detail Drawings



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Size: 4m x 6m
Height: 3.4 m
Clearance: 19 m²
Frame Profile: 260 mm Diameter
Weight: 40kg

Size: 5m x 10m
Height: 3.8m
Clearance: 40m
Frame Profile: 330 mm Diameter
Weight: 60kg

Fabric:
400D PU Coated Polyester

Warranty:
TPU Frame: 6 months
Fabric: Polyester
Plain & Printed 1 Year

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