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STRUCTURAL CALCULATIONS

FOR

EXTREME MARQUEES
australia's biggest range of outdoor branding solutions

EXTREME MARQUEES
AUSTRALIA WIDE
Company website: www.extrememarquees.com.au
TEL: 1300-850-832

EXTREME MARQUEES TENTS
K2 Range 3x3, 3x4.5, 3x6 m

Prepared by -:

Edward Arthur Bennett

....
Civil and Structural Engineering Design Services Pty Ltd

CONTENTS

1.0 INTRODUCTION

This Certification is the sole property for copyright to Mr. Ted Bennett of Civil & Structural Engineering Design Services Pty. Ltd. and a licence holder for the exclusive use of these Certifications by EXTREME MARQUEES.

The following structural drawings and calculations are for the transportable tents supplied by EXTREME MARQUEES.

The frame consists of extruded aluminium (grade 6005 T5) connector, Leg outer, Leg Inner and Truss. The base plate is generally anchored in position with driven 25mm diameter 350 grade steel stakes x 850mm long.

Please refer to the structural drawings for further information on the components and assembly of the tents.

2.0 DESIGN RESTRICTIONS AND LIMITATIONS

The erected structure is for temporary use only and is limited to 6 months maximum at any one site establishment.

It should be noted that if high gust wind speeds are anticipated or forecast in the locality of the tent. For forecast winds in excess of 80km/hr or 22m/s, all fabric shall be removed from the frames and the structure should be completely dismantled.

Please note that the locality squall or gust wind speed is affected by factors such as terrain exposure and site elevations.

Live load or occasional loads are limited to a single maximum suspended load of 140kg located at the ridge connection, unless noted otherwise note and if a larger load is required the Engineer should be notified so that a revision calculation may be carried out for approval.

The structure may only be erected in regions with wind classifications no greater than the limits specified on the attached wind analysis (Regional Wind Speed Region A (1-7).

The wind classifications are based upon the regional wind terrain category, topographical location and site shielding from adjacent structures. Please note that in many instances topographical factors such as a location on the crest of a hill or on top of an escarpment may yield a higher wind speed classification than that derived for a higher wind terrain category in a level topographical region. For this reason, particular regard shall be paid to the topographical location of the structure. For localities which do not conform to the standard prescribed descriptions for wind classes as defined above, a qualified structural engineer may be employed to determine an appropriate wind class for that the particular site.

The structures in no circumstances shall ever be erected in tropical or severe tropical cyclonic zones as defined on the Map of Australia in AS 1170.2-2002 shown in figure.

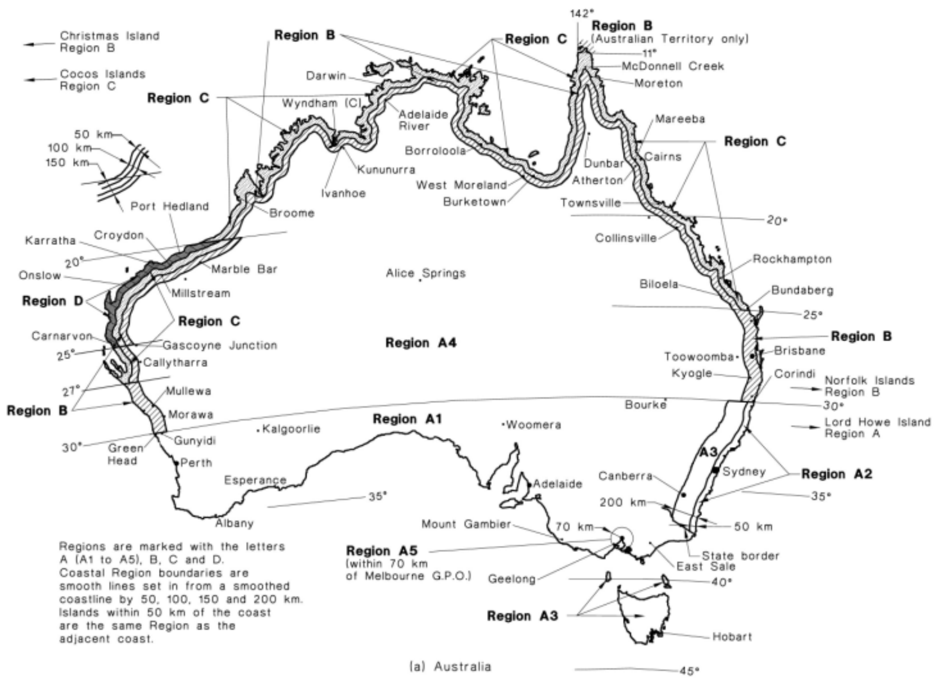


Figure 0.1: Different wind regions in Australia from the Australian Standards AS 1170.2

The column base plate anchorage shall comply with the attached structural drawings for various wind classes and soil types. The steel stakes specified shall have a minimum embedment of 800mm into the soil. For cases where the soil types vary within the depth of the stake, the soil variety which requires the greater number of stakes shall be used.

The tent structures have not been designed to withstand additional snow loadings such as when erected in alpine regions.

For large scale projects, or where the site conditions approach the design limits for the structure, consideration should be given to pullout tests of the stakes and professional assessment of the appropriate wind classification for the site.

TENT BASE ANCHORAGE REQUIREMENTS

TENT SIZE	SOIL	Wind Classification	
		W80 km/hr (STAKES PER UPRIGHT)	W80 km/hr (WEIGHT PER UPRIGHT)
2.4.0x2.4 m (4 legs)	A	2	
	B	1	
	C	1	
	D	1	
	E	2	60 kg
3.0x3.0 m (4 legs)	A	2	
	B	1	
	C	1	
	D	1	
	E	2	75 kg
3.0x4.5 m (4 legs)	A	2	
	B	1	
	C	1	
	D	1	
	E	2	120 kg
3.0x6.0 m (6 legs)	A	2	
	B	1	
	C	1	
	D	1	
	E	2	100 kg
5.7x5.7 m (8 legs)	A	4	
	B	4	
	C	4	
	D	4	

	E	4	80 kg
4.0x4.0 m (4 legs)	A	4	
	B	4	
	C	4	
	D	4	
	E	4	100 kg
4.0x6.0 m (4 legs)	A	4	
	B	4	
	C	4	
	D	4	
	E	4	150 kg
4.0x8.0 m (6 legs)	A	4	
	B	4	
	C	4	
	D	4	
	E	4	130 kg

Definitions of soil types:

Type A: Loose sand such as dunal sand. Uncompacted site filling may also be included in this soil type.

Type B: Medium to stiff clays or silty clays.

Type C: Moderately compact sand or gravel e.g., alluvial origin.

Type D: Compact sand and gravel e.g., weathered sandstone or compacted quarry rubble hardstand.

Type E: Concrete slab on ground (see weighted column). Number Stated are for M16 Dynabolts, 70mm min embedment, 150mm min spacing, min edge distance on slab 80mm.

Stakes: Consist of 25mm diameter 350 grade steel x 850mm long with an integral head, driven to a minimum depth of 800mm into the soil.

3.0 TENT SPECIFICATIONS

	Material	Member	Height	Size
Explorer range	Aluminium T5 6005 grade	30x30x2	3.29	3x3 3x4.5 3x6
K2 range	Aluminium T5 6005 grade	37x37x2	3.29	3x3 3x4.5 3x6
Summit range	Aluminium T5 6005 grade	40x40x2	2.99 3.29 3.73 4.02	2.4x2.4 3x3 3x4.5 3x6 4x4 4x8 5.7
Tectonic range	Aluminium T5 6005 grade	57x50x2	2.99 3.29 3.73	2.4x2.4 3x3 3x4.5 3x6 4x4 4x6 4x8

Figure 3.1: Tent Specifications

EXTREME MARQUEES

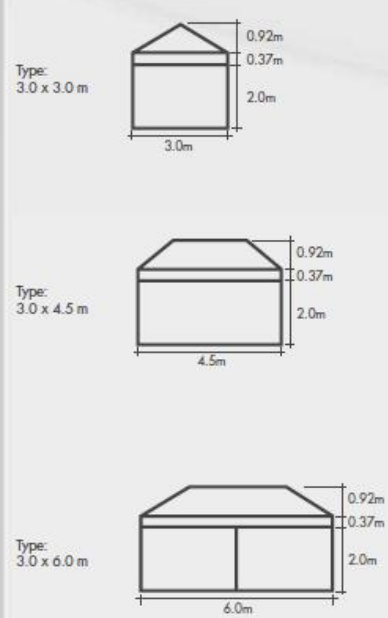
Explorer Range Folding Marquees

3x3m / 3x4.5m / 3x6m

Product Photos

Item	Specification
Size	3x3m / 3x4.5m / 3x6m
Height	3.29m
Clearance	2.0m
Roof Tension System	75mm Stainless Steel Spring
Nuts / Bolts	Stainless Steel
Main Profile	30 x 30 x 2mm
Feet	Metal
Connectors	Extruded Aluminium
Framework Material	6063/T5
Cover Material	580GSM Imported Belgian PVC or Polyester enforced polyester

Technical Diagrams



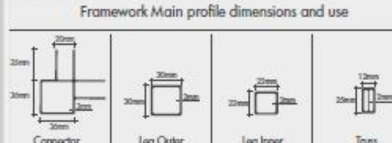
Product Info

The Explorer 30 is a family favourite for BBQs in the backyard or picnics. It makes a fantastic cook tent for camping. Sports enthusiasts and parents can take their Explorer along to events and set up in just 60 seconds.

Accessories:
- Full Walls
- Half Walls
- Weights
- Steel Pins
- Awnings
- Gutters
- Ceilings

Profiles

Framework Main profile dimensions and use



www.extrememarquees.com.au call 1300 850 832

EXTREME MARQUEES

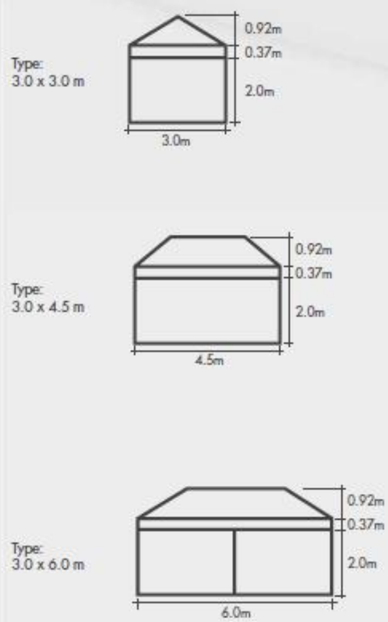
K2 Range Folding Marquees

3x3m / 3x4.5m / 3x6m

Product Photos

Item	Specification
Size	3x3m / 3x4.5m / 3x6m
Height	3.29m
Clearance	2.0m
Roof Tension System	75mm Stainless Steel Spring
Nuts / Bolts	Stainless Steel
Main Profile	37 x 37 x 2mm
Feet	Metal
Connectors	Extruded Aluminium
Framework Material	6063/T5
Cover Material	580GSM Imported Belgian PVC or Polyester enforced polyester

Technical Diagrams



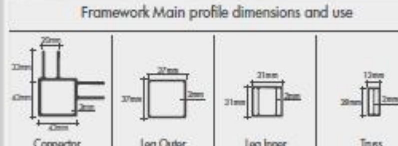
Product Info

The K2 37 is proven and popular with schools, charities, sports clubs and child care centres. Regular campers, motorsport enthusiasts and pit crews and market stallers appreciate the design and value of the K2 37.

Accessories:
- Full Walls
- Half Walls
- Weights
- Steel Pins
- Awnings
- Gutters
- Ceilings

Profiles

Framework Main profile dimensions and use



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Summit Range Folding Marquees

2.4x2.4m/3x3m/3x4.5m/3x6m/4x4m/4x8m/5.7m hex

Product Photos

Item	Specification
Size	2.4x2.4m / 3x3m / 3x4.5m / 3x6m 4x4m / 4x8m / 5.7m hex
Height	2.99m (2.4x2.4), 3.29m (3x3, 3x4.5,3x6) 3.73m (4x4, 4x8), 4.02 (5.7)
Clearance	2.0m
Roof Tension System	75mm Stainless Steel Spring
Nuts / Bolts	Stainless Steel
Main Profile	40 x 40 x 2mm
Feet	Metal
Connectors	Extruded Aluminium
Framework Material	6063/T5
Cover Material	580GSM Imported Belgian PVC or Polyester enforced polyester

Technical Diagrams

Type: 2.4 x 2.4 m

Type: 3.0 x 3.0 m

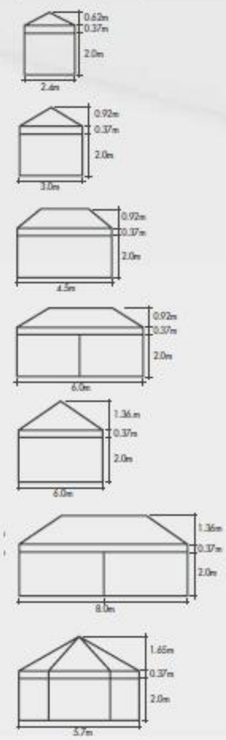
Type: 3.0 x 4.5 m

Type: 3.0 x 6.0 m

Type: 4.0 x 4.0 m

Type: 4.0 x 8.0 m

Type: 5.7 x 5.7 m



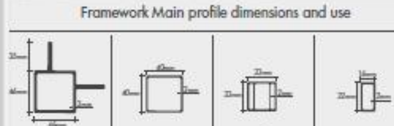
Product Info

Applications
The SUMMIT 40 has been the choice for thousands of corporate marketers, SME business buyers, sporting clubs, larger school customers and regular market stall operators.

Accessories:
- Full Walls
- Half Walls
- Weights
- Steel Pins
- Awnings
- Gutters
- Ceilings

Profiles

Framework Main profile dimensions and use



www.extrememarquees.com.au call 1300 850 832

EXTREME MARQUEES

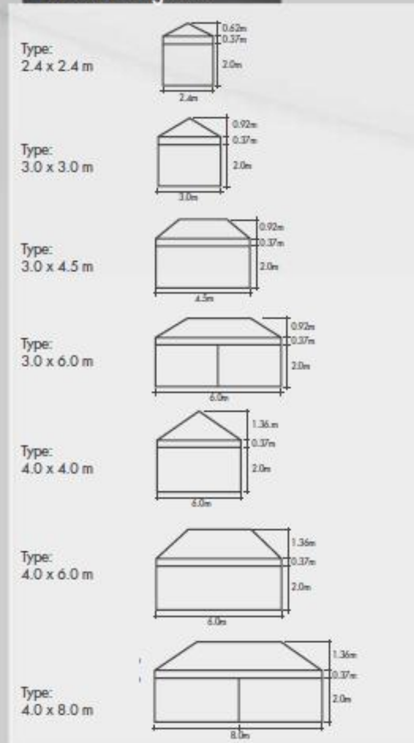
Tectonic Range Folding Marquees

2.4x2.4m/3x3m/3x4.5m/3x6m/4x4m/4x6m/4x8m

Product Photos

Item	Specification
Size	2.4x2.4m / 3x3m / 3x4.5m / 3x6m 4x4m / 4x6m / 4x8m
Height	2.99m (2.4x2.4), 3.29m (3x3, 3x4.5,3x6) 3.73m (4x4, 4x6, 4x8),
Clearance	2.0m
Roof Tension System	75mm Stainless Steel Spring
Nuts / Bolts	Stainless Steel
Main Profile	57 x 50 x 2mm
Feet	Metal
Connectors	Extruded Aluminium
Framework Material	6061/T6
Cover Material	580GSM Imported Belgian PVC or Polyester enforced polyester

Technical Diagrams



Product Info

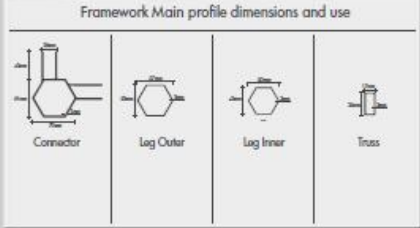
Tectonic 50 is suitable for:
usage in the regular tough conditions experienced by hire companies, military, emergency services, surf clubs, industrial and mining companies.

The Tectonic 50 is the benchmark in material quality because it is made from high strength 6061 T6 aluminium. This superior grade of aluminium is normally reserved for our very large event marquees.

Accessories:
- Full Walls
- Half Walls
- Weights
- Steel Pins
- Awnings
- Gutters
- Ceilings

Profiles

Framework Main profile dimensions and use



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3.1 DESIGN WIND PRESSURE AND CALCULATION

TEDDS calculation version 1.0.05;

Regional wind speeds (cl. 3.2)

Regional wind speeds (V_R) for all directions based on 3 second gust wind data shall be as given in Table 3.1 AS/NZS 1170.2 for the regions shown in Figure 3.1 where R (average recurrence interval) is the inverse of the annual probability of exceedance of the wind speed. Refer to AS/NZS 1170.0 for information on values of annual probability of exceedance appropriate.

Inverse of annual probability of wind speed exceedance;

R = **1**

;

;

Regional wind speed, Region A (1 to 7); V_R = ;**30**; m/s

Multipliers

Wind direction multiplier (cl. 3.3)

The wind direction multiplier (M_d) shall be as follows for each cardinal direction (given in Table 3.2 AS/NZS 1170.2).

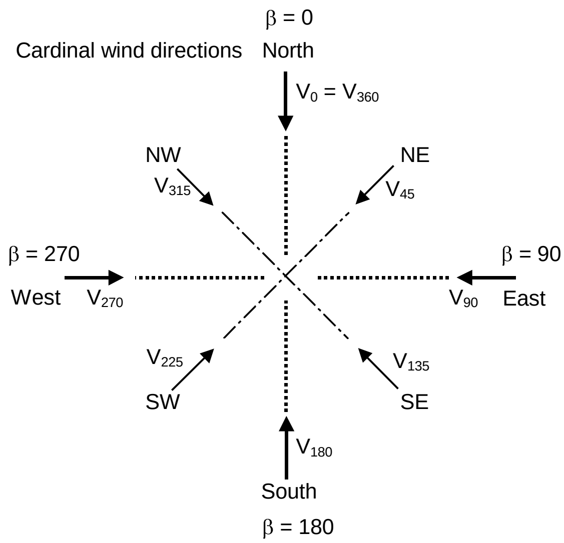
Region A2

North, north-east, east;	$M_{d.N} = M_{d.NE} = M_{d.E} = 0.8$
South-east, south-west, north-west;	$M_{d.SE} = M_{d.SW} = M_{d.NW} = 0.95$
South;	$M_{d.S} = 0.9$
West;	$M_{d.W} = M_d = 1.0$
Terrain/height multiplier (cl. 4.2)	
Terrain category;	$Terrain_{Cat}$ = **1** ;
Height;	z = **3.00** m
Terrain/height multiplier (Table 4.1(A));	M_{zcat1} = **0.99**
Shielding multiplier (cl. 4.3);	M_s = **1.00**
Topographic multiplier (cl. 4.4);	M_t = **1.00**

Site wind speed (cl. 2.2)

Site wind speed; $V_{sit.\beta} = V_R \times M_d \times (M_{z.cat} \times M_s \times M_t)$

The site wind speed is independent of the type or shape of structure.

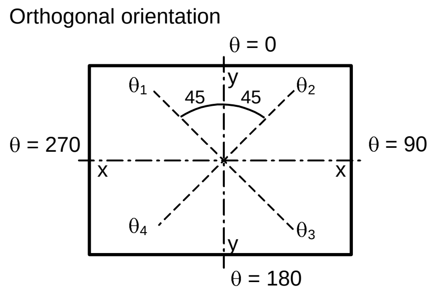


Ultimate limit state and serviceability limit state for regions A(1 to 7) and W

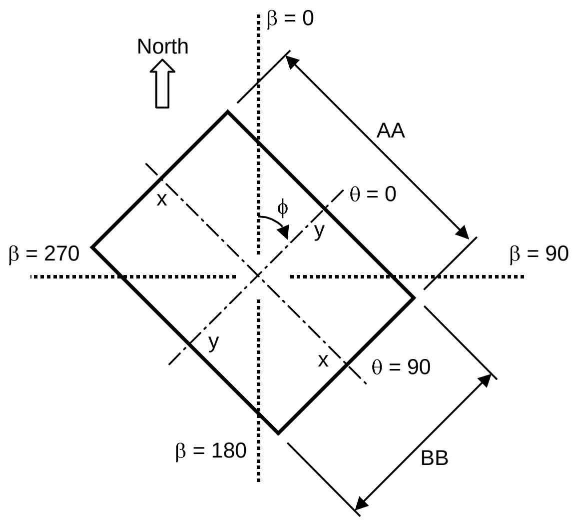
North;	$V_0 = V_{360} = V_{sit.N} = V_R \times M_{d.N} \times (M_{zcat1} \times M_s \times M_t) =$ **23.76** m/s
North-east;	$V_{45} = V_{sit.NE} = V_R \times M_{d.NE} \times (M_{zcat1} \times M_s \times M_t) =$ **23.76** m/s
East;	$V_{90} = V_{sit.E} = V_R \times M_{d.E} \times (M_{zcat1} \times M_s \times M_t) =$ **23.76** m/s
South-east;	$V_{135} = V_{sit.SE} = V_R \times M_{d.SE} \times (M_{zcat1} \times M_s \times M_t) =$ **28.22** m/s
South;	$V_{180} = V_{sit.S} = V_R \times M_{d.S} \times (M_{zcat1} \times M_s \times M_t) =$ **26.73** m/s
South-west;	$V_{225} = V_{sit.SW} = V_R \times M_{d.SW} \times (M_{zcat1} \times M_s \times M_t) =$ **28.22** m/s
West;	$V_{270} = V_{sit.W} = V_R \times M_{d.W} \times (M_{zcat1} \times M_s \times M_t) =$ **29.70** m/s
North-west;	$V_{315} = V_{sit.NW} = V_R \times M_{d.NW} \times (M_{zcat1} \times M_s \times M_t) =$ **28.22** m/s

Design wind speed (cl. 2.3)

The design wind speed ($V_{des.\theta}$) equals the maximum value of site wind speed in the range $\theta = \beta$ +/- 45° where β is the cardinal direction clockwise from true North and θ is the angle to the building orthogonal axes. The design wind speed considers directional effects and variations with height.



Orientate building;	$\phi =$ **90.0**° ; (angle between β = 0° and θ = 0°)



Using cardinal coordinates; θ_1 = if(ϕ < 45, (ϕ - 45) + 360, ϕ - 45) = **45.0°**

θ_2 = if(ϕ > 315, (ϕ + 45) - 360, ϕ + 45) = **135.0°**

θ_3 = if(ϕ > 225, (ϕ + 135) - 360, ϕ + 135) = **225.0°**

θ_4 = if(ϕ > 135, (ϕ + 225) - 360, ϕ + 225) = **315.0°**

Site wind speed in the range θ = β +/- 45°

$V_{\theta 1} = V_{45} - (V_{45} - V_{90}) \times (45 - \theta_1) / -45$ = **23.76** m/s

$V_{\theta 2} = V_{135} - (V_{135} - V_{180}) \times (135 - \theta_2) / -45$ = **28.22** m/s

$V_{\theta 3} = V_{225} - (V_{225} - V_{270}) \times (225 - \theta_3) / -45$ = **28.22** m/s

$V_{\theta 4} = V_{315} - (V_{315} - V_{360}) \times (315 - \theta_4) / -45$ = **28.22** m/s

Design wind speed (maximum value of site wind speed in the range θ = β +/- 45°);

At 0 degrees; $V_{des.\theta 0} = \max(V_{\theta 1}, V_{90}, V_{135}, V_{\theta 2})$ = **28.22** m/s

At 90 degrees; $V_{des.\theta 90} = \max(V_{\theta 2}, V_{180}, V_{225}, V_{\theta 3})$ = **28.22** m/s

At 180 degrees; $V_{des.\theta 180} = \max(V_{\theta 3}, V_{270}, V_{315}, V_{\theta 4})$ = **29.70** m/s

At 270 degrees; $V_{des.\theta 270} = \max(V_{\theta 4}, V_{360}, V_{45}, V_{\theta 1})$ = **28.22** m/s

Wind pressure (cl. 2.4)

Density of air; ρ_{air} = **1.2** kg/m^3

Design wind pressure; $p = 0.5 \times \rho_{air} \times V_{des.\theta}^2 \times C_{fig} \times C_{dyn}$

Wind pressure

At 0 degrees; $p_{\theta 0} = 0.5 \times \rho_{air} \times V_{des.\theta 0}^2$ = **0.48** kPa

At 90 degrees; $p_{\theta 90} = 0.5 \times \rho_{air} \times V_{des.\theta 90}^2$ = **0.48** kPa

At 180 degrees; $p_{\theta 180} = 0.5 \times \rho_{air} \times V_{des.\theta 180}^2$ = **0.53** kPa

At 270 degrees; $p_{\theta 270} = 0.5 \times \rho_{air} \times V_{des.\theta 270}^2$ = **0.48** kPa

Aerodynamic shape factor for enclosed building (cl. 5.2a)

The following calculations collate the internal and external pressure coefficients for an enclosed rectangular building.

The coefficients have been combined with wind pressures for each orthogonal direction. The combination of the external and internal pressures needs to be conducted separately. When combining the pressures, the Combination factors, $K_{c,e}$ & $K_{c,i}$ (refer to Table 5.5 for appropriate values of $K_{c,e}$ & $K_{c,i}$), and the Area reduction factor, K_a, need to be included. The Area reduction factor, K_a, makes the pressure applicable to the specific structural element and force being considered.

No local pressure factor (K_l) has been included in the following calculations and this should be considered separately.

No consideration or reduction has been made for permeable cladding (K_p) in the calculation.

External pressures; $C_{fig} = C_{p.e} \times K_a \times K_{c,e} \times K_l \times K_p$

Internal pressures; $C_{fig} = C_{p.i} \times K_{c,i}$

External pressure coefficients for enclosed rectangular buildings (cl. 5.4)

Building dimensions; h = **3.1** m

AA = **8.0** m

BB = **4.0** m

Roof slope; α = **45.0** °

Ratios for θ = 0/180; $d\_on\_b_{\theta0}$ = BB / AA = **0.50**

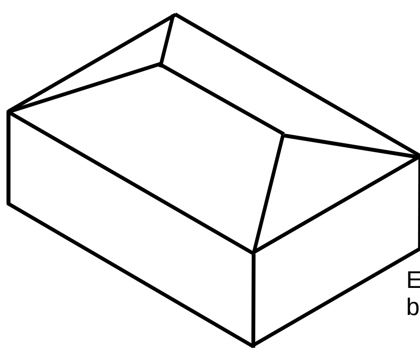
$h\_on\_d_{\theta0}$ = h / BB = **0.76**

$\alpha_{\theta0} = \alpha$

Ratios for θ = 90/270; $d\_on\_b_{\theta90}$ = AA / BB = **2.00**

$h\_on\_d_{\theta90}$ = h / AA = **0.38**

$\alpha_{\theta90} = \alpha$



Enclosed rectangular buildings - hip roofs

Coefficients for Hip roof when $\alpha \geq 10°$;

Roof	Orthogonal direction			
	0/180		90/270	
T5.3B (U)	$C_{p.e.U1\theta0}$	$C_{p.e.U2\theta0}$	$C_{p.e.U1\theta90}$	$C_{p.e.U2\theta90}$

	0.00	**0.57**	**0.00**	**0.57**
T5.3C (D) & (R)	$C_{p.e.D1\theta0}$		$C_{p.e.D1\theta90}$	
	-0.60		**-0.60**	

Pressure for Hip roof when α ≥ 10°;

Roof	Orthogonal direction			
	0 (kPa)		180 (kPa)	
(U)	$p_{U1\theta0}$	$p_{U2\theta0}$	$p_{U1\theta180}$	$p_{U2\theta180}$
	0.00	**0.27**	**0.00**	**0.30**
(D) & (R)	$p_{D1\theta0}$		$p_{D1\theta180}$	
	-0.29		**-0.32**	

Roof	Orthogonal direction			
	90 (kPa)		270 (kPa)	
(U)	$p_{U1\theta90}$	$p_{U2\theta90}$	$p_{U1\theta270}$	$p_{U2\theta270}$
	0.00	**0.27**	**0.00**	**0.27**
(D) & (R)	$p_{D1\theta90}$		$p_{D1\theta270}$	
	-0.29		**-0.29**	

Coefficients for Windward and Leeward walls in each orthogonal direction;

Walls	Orthogonal direction			
	0	90	180	270
Windward T5.2A (W);	$C_{p.e.W\theta0}$	$C_{p.e.W\theta90}$	$C_{p.e.W\theta180}$	$C_{p.e.W\theta270}$
	0.70	**0.70**	**0.70**	**0.70**
Leeward T5.2B (L);	$C_{p.e.L\theta0}$	$C_{p.e.L\theta90}$	$C_{p.e.L\theta180}$	$C_{p.e.L\theta270}$
	-0.50	**-0.50**	**-0.50**	**-0.50**

Pressure for Windward and Leeward walls in each orthogonal direction;

Walls	Orthogonal direction			
	0 (kPa)	90 (kPa)	180 (kPa)	270 (kPa)
Windward T5.2A (W);	$p_{W\theta0}$	$p_{W\theta90}$	$p_{W\theta180}$	$p_{W\theta270}$
	0.33	**0.33**	**0.37**	**0.33**
Leeward T5.2B (L);	$p_{L\theta0}$	$p_{L\theta90}$	$p_{L\theta180}$	$p_{L\theta270}$
	-0.24	**-0.24**	**-0.26**	**-0.24**

Coefficients for Side walls in each orthogonal direction;

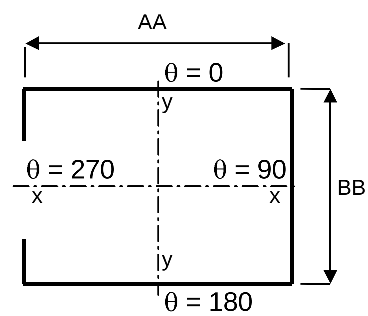
Horizontal distance from windward edge	T5.2C - Side walls (S)			
	Orthogonal direction			
	0	90	180	270
0 to 1h	$C_{p.e.S.0\_1h\theta0}$	$C_{p.e.S.0\_1h\theta90}$	$C_{p.e.S.0\_1h\theta180}$	$C_{p.e.S.0\_1h\theta270}$
	-0.65	-0.65	-0.65	-0.65
1h to 2h	$C_{p.e.S.1\_2h\theta0}$	$C_{p.e.S.1\_2h\theta90}$	$C_{p.e.S.1\_2h\theta180}$	$C_{p.e.S.1\_2h\theta270}$
	-0.5	-0.5	-0.5	-0.5
2h to 3h	$C_{p.e.S.2\_3h\theta0}$	$C_{p.e.S.2\_3h\theta90}$	$C_{p.e.S.2\_3h\theta180}$	$C_{p.e.S.2\_3h\theta270}$
	-0.3	-0.3	-0.3	-0.3
>3h	$C_{p.e.S.3h\theta0}$	$C_{p.e.S.3h\theta90}$	$C_{p.e.S.3h\theta180}$	$C_{p.e.S.3h\theta270}$
	-0.2	-0.2	-0.2	-0.2

Pressure for Side walls in each orthogonal direction;

Horizontal distance from windward edge	Orthogonal direction			
	0 ($C_{p.e.S} \times p_{\theta0}$) kPa	90 ($C_{p.e.S} \times p_{\theta90}$) kPa	180 ($C_{p.e.S} \times p_{\theta180}$) kPa	270 ($C_{p.e.S} \times p_{\theta270}$) kPa
0 to 1h	$p_{S.0\_1h\theta0}$	$p_{S.0\_1h\theta90}$	$p_{S.0\_1h\theta180}$	$p_{S.0\_1h\theta270}$
	-0.31	**-0.31**	**-0.34**	**-0.31**
1h to 2h	$_{S.1\_2h\theta0}$	$_{S.1\_2h\theta90}$	$_{S.1\_2h\theta180}$	$_{S.1\_2h\theta270}$
	-0.24	**-0.24**	**-0.26**	**-0.24**
2h to 3h	$p_{S.2\_3h\theta0}$	$p_{S.2\_3h\theta90}$	$p_{S.2\_3h\theta180}$	$p_{S.2\_3h\theta270}$
	-0.14	**-0.14**	**-0.16**	**-0.14**
>3h	$p_{S.3h\theta0}$	$p_{S.3h\theta90}$	$p_{S.3h\theta180}$	$p_{S.3h\theta270}$
	-0.10	**-0.10**	**-0.11**	**-0.10**

Internal pressure coefficients (cl. 5.3)

From Table 5.1(b) - internal pressure coefficients for buildings with open interior plan
- dominant openings on one surface



Coefficients where ratio of dominant opening to total open area is 0.5 or less

Minimum C_{pi}; $C_{p.i.1\theta 0} = C_{p.i.1\theta 90} = C_{p.i.1\theta 180} = C_{p.i.1\theta 270} = -0.3$

Maximum C_{pi}; $C_{p.i.2\theta 0} = C_{p.i.2\theta 90} = C_{p.i.2\theta 180} = C_{p.i.2\theta 270} = 0.0$

Internal coefficients and pressure for each orthogonal direction;

Orthogonal direction	Internal pressure coefficients (cl. 5.3)	
0	$C_{p.i.1\theta 0}$	$C_{p.i.2\theta 0}$
	-0.30	**0.00**
	$p_{i.1\theta 0}$ (kPa)	$p_{i.2\theta 0}$ (kPa)
	-0.14	**0.00**
90	$C_{p.i.1\theta 90}$	$C_{p.i.2\theta 90}$
	-0.30	**0.00**
	$p_{i.1\theta 90}$	$p_{i.2\theta 90}$
	-0.14	**0.00**
180	$C_{p.i.1\theta 180}$	$C_{p.i.2\theta 180}$
	-0.30	**0.00**
	$p_{i.1\theta 180}$	$p_{i.2\theta 180}$
	-0.16	**0.00**
270	$C_{p.i.1\theta 270}$	$C_{p.i.2\theta 270}$
	-0.30	**0.00**
	$p_{i.1\theta 270}$	$p_{i.2\theta 270}$
	-0.14	**0.00**

3.2 STRUCTURAL ANALYSIS

K2 Range 3.0x3.0; 3.0x4.5; 3.0x6.0

Section Property Data

Sec No	Vertical	Horizontal
1	43x43x3 SHS	28x13x2 RHS

Material Property Data

Mat No	Youngs Mod N/mm2	Shear Mod N/mm2	Material Name
1	70,000,000	26,000.0000	Aluminium

3.2.1 Deflection

E.g. 3x4.5 m

4 walls closed	Vertical 43x43x3 Truss 28x13x2 **(80 km/hr)**		Vertical 43x43x3 Truss 28x13x2 **(50 km/hr)**		Allowable horizontal (y); Allowable vertical (x,z)
	Braced	Unbraced	Braced	Unbraced	
Max deflection in x direction	40 mm	41 mm	17 mm*	17 mm	14 mm
Max deflection in y direction	46 mm	59 mm	20 mm*	24 mm	18 mm
Max deflection in z direction	52 mm	64 mm	20 mm*	25 mm	14 mm

3 walls closed	Vertical 43x43x3 Truss 28x13x2 **(80 km/hr)**		Vertical 43x43x3 Truss 28x13x2 **(50 km/hr)**		Allowable horizontal (y); Allowable vertical (x,z)
	Braced	Unbraced	Braced	Unbraced	
Max deflection in x direction	20 mm	24 mm	11 mm	11 mm	14 mm
Max deflection in y direction	46 mm	59 mm	18 mm	23 mm	18 mm
Max deflection in z direction	45 mm	64 mm	18 mm*	25 mm	14 mm

2 walls closed	Vertical 43x43x3 Truss 28x13x2 **(80 km/hr)**		Vertical 43x43x3 Truss 28x13x2 **(50 km/hr)**		Allowable horizontal (y); Allowable vertical (x,z)
	Braced	Unbraced	Braced	Unbraced	

Max deflection in x direction	15 mm	15 mm	6 mm	6 mm	14 mm
Max deflection in y direction	46 mm	61 mm	18 mm	24 mm*	18 mm
Max deflection in z direction	45 mm	72 mm	18 mm*	28 mm*	14 mm

1 wall closed	Vertical 43x43x3 Truss 28x13x2 **(80 km/hr)**		Vertical 43x43x3 Truss 28x13x2 **(50 km/hr)**		Allowable horizontal (y); Allowable vertical (x,z)
	Braced	Unbraced	Braced	Unbraced	
Max deflection in x direction	8 mm	8 mm	3 mm	3 mm	14 mm
Max deflection in y direction	31 mm	37 mm	12 mm	14 mm	18 mm
Max deflection in z direction	24 mm	33 mm	10 mm	13 mm	14 mm

Roof only	Vertical 43x43x3 Truss 28x13x2 **(80 km/hr)**		Vertical 43x43x3 Truss 28x13x2 **(50 km/hr)**		Allowable horizontal (y); Allowable vertical (x,z)
	Braced	Unbraced	Braced	Unbraced	
Max deflection in x direction	9 mm	9 mm	3 mm	3 mm	14 mm
Max deflection in y direction	22 mm	22 mm	9 mm	9 mm	18 mm
Max deflection in z direction	8 mm	8 mm	4 mm	4 mm	14 mm

Although the deflection values marked with * have exceeded the limits stated in the Australian Standards for serviceability, the members will recover without failure as shown by calculations in the next section.

3.2.2 Moment and Shear

Moment	
Max moment in y direction	0.34 kNm
Max moment in z direction	0.20 kNm

Shear	
Max shear in x direction	1.63 kN
Max shear in y direction	0.68 kN
Max shear in z direction	0.76 kNm

3.2.3 Calculations

Knee connection

Vertical 43x43x3; Truss 28x13x2

M^*_{max} = 0.34 kNm at haunch

For 43x43x3 Member

$\emptyset M_{sx} = \emptyset f_y S_x$ where $Z_{ex} = S_x$

$$S_x = \frac{td^2}{2} + (b - 2t)(d - t)t$$

$S_x = (3x43^2)/2 + (43\text{-}2x3)(43\text{-}3)3$

S_x = 2773.5 + 4440 mm^3

S_x = 7213.59 mm^3

$\emptyset M_{sx}$ = 0.9 x 350 S_x = 2.27 kNm > M^*

Moment Capacity

Horizontal 28x13x2

$M^* \leq \Phi M_t$

M^* = 0.13

ΦM_t = 0.9 x 210 x 13413/14

ΦM_t = 0.18 kNm

$\Phi M_t > M^*$

(Therefore no member buckling)

Vertical 43x43x3

$M^* \leq \Phi M_t$

$M^* = 0.34$

$\Phi M_t = 0.9 \times 210 \times 93200/21.5$

$\Phi M_t = 0.82$ kNm

$\Phi M_t > M^*$ (Checked)

(Therefore no member buckling)

Check Base Plate

N*t (max) = 4.12kN

$M^* = (0.34 \times 10^6/2) \times (0.125) = 21250$

$T \geq \sqrt{[(4 \times M^*)/(0.9 \times 200 \times 250)]}$

= 1.37 mm

<u>Use base 250x250x7.8 base plate. For anchorage refer to requirements table (2.0 Design Restrictions)</u>

3.2.4 Summary

SUMMARY OF ALLOWABLE WIND SPEEDS FOR EXTREME MARQUEES FOLDING RANGE - 15/12/2011

TYPE OF STRUCTURE		4 walls closed		3 walls closed		2 walls closed		1 wall closed		Roof Only	
		Unbraced	**Braced**	**Unbraced**	**Braced**	**Unbraced**	**Braced**	**Unbraced**	**Braced**	**Unbraced**	**Braced**
Explorer	**3x3**	30 km/hr	40 km/hr	30 km/hr	40 km/hr	30 km/hr	40 km/hr	40 km/hr	50 km/hr	70 km/hr	80 km/hr
	3x4.5	30 km/hr	40 km/hr	30 km/hr	40 km/hr	30 km/hr	40 km/hr	40 km/hr	50 km/hr	70 km/hr	80 km/hr
	3x6	10 km/hr	20 km/hr	10 km/hr	20 km/hr	10 km/hr	20 km/hr	20 km/hr	30 km/hr	30 km/hr	30 km/hr
K2	**3x3**	40 km/hr	50 km/hr	40 km/hr	50 km/hr	40 km/hr	50 km/hr	50 km/hr	60 km/hr	80 km/hr	80 km/hr
	3x4.5	40 km/hr	50 km/hr	40 km/hr	50 km/hr	40 km/hr	50 km/hr	50 km/hr	60 km/hr	80 km/hr	80 km/hr
	3x6	20 km/hr	30 km/hr	20 km/hr	30 km/hr	20 km/hr	30 km/hr	30 km/hr	40 km/hr	80 km/hr	80 km/hr
Summit	**2.4x2.4**	50 km/hr	60 km/hr	50 km/hr	60 km/hr	50 km/hr	60 km/hr	60 km/hr	70 km/hr	80 km/hr	80 km/hr
	3x3	50 km/hr	60 km/hr	50 km/hr	60 km/hr	50 km/hr	60 km/hr	60 km/hr	70 km/hr	80 km/hr	80 km/hr
	3x4.5	50 km/hr	60 km/hr	50 km/hr	60 km/hr	50 km/hr	60 km/hr	40 km/hr	50 km/hr	80 km/hr	80 km/hr
	3x6	30 km/hr	40 km/hr	30 km/hr	40 km/hr	30 km/hr	40 km/hr	40 km/hr	50 km/hr	80 km/hr	80 km/hr
	4x4	30 km/hr	40 km/hr	30 km/hr	40 km/hr	30 km/hr	40 km/hr	40 km/hr	50 km/hr	80 km/hr	80 km/hr
	4x8	10 km/hr	20 km/hr	10 km/hr	20 km/hr	10 km/hr	20 km/hr	30 km/hr	40 km/hr	60 km/hr	60 km/hr
	5.7x5.7	30 km/hr	30 km/hr	40 km/hr	40 km/hr	40 km/hr	40 km/hr	40 km/hr	40 km/hr	60 km/hr	60 km/hr
Tectonic	**2.4x2.4**	50 km/hr	60 km/hr	50 km/hr	60 km/hr	50 km/hr	60 km/hr	60 km/hr	70 km/hr	80 km/hr	80 km/hr
	3x3	50 km/hr	60 km/hr	50 km/hr	60 km/hr	50 km/hr	60 km/hr	60 km/hr	70 km/hr	80 km/hr	80 km/hr
	3x4.5	50 km/hr	60 km/hr	40 km/hr	50 km/hr	50 km/hr	60 km/hr	50 km/hr	60 km/hr	80 km/hr	80 km/hr
	3x6	40 km/hr	50 km/hr	40 km/hr	50 km/hr	40 km/hr	50 km/hr	50 km/hr	60 km/hr	80 km/hr	80 km/hr
	4x4	40 km/hr	50 km/hr	40 km/hr	50 km/hr	40 km/hr	50 km/hr	50 km/hr	60 km/hr	80 km/hr	80 km/hr
	4x6	30 km/hr	40 km/hr	30 km/hr	40 km/hr	40 km/hr	50 km/hr	50 km/hr	60 km/hr	80 km/hr	80 km/hr
	4x8	30 km/hr	40 km/hr	30 km/hr	40 km/hr	30 km/hr	40 km/hr	50 km/hr	60 km/hr	70 km/hr	70 km/hr

Civil & Structural Engineering Design Services Pty. Ltd.

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3 Wanniti Road BELROSE NSW 2085 **Tel: 02 9975 3899 Fax: 02 99751943**
Email: hited@bigpond.net.au **Web: www.civilandstructural.com.au**

22nd Dec 2011

Mr. Greg McMahon
Extreme Marquees Pty Ltd #M-11-260471

100 Pickering Street
Enoggera QLD 4051

Dear Sir,

Certificate of Adequacy for Design of Temporary Structures

K2 3x3, 3x4.5, 3x6 with 4, 3, 2, 1 walls and roof only throughout Australia

I, Edward A. Bennett, practicing structural Engineer, hereby certify that I have carried out computations in accordance with proper design principles for the purpose of certifying the structural adequacy of the above tents to be erected as a temporary structure at various sites throughout Australia that meet the Design Restrictions and Limitations within the computations. These structures should only be erected under the maximum wind speeds stated in the summary table.

I am able to confirm that these Temporary Structures should be erected with weights/tie downs in accordance with the BCA Section B, *"Structural Provisions"*, AS 1170.1 & 2-2002, *"Structural Design Actions"* and AS 1170.2, 2002 *"Wind Actions"*, such that I am able to issue this "Certificate of Adequacy - Design".

Full Name of Designer: **Edward Arthur Bennett**
Qualifications: **M.I.E. Aust. CPE NPER 198230**
Address of Designer: **3 Wanniti Road, Belrose NSW 2085**
Business Telephone No.: **Phone: (02) 9975 3899 Fax: 9974 1943**
Name of Employer: **Civil & Structural Engineering Design Services Pty. Ltd.**

Yours faithfully,

E.A. Bennett M.I.E. Aust. BPB NSW-0282 & BPB VIC – EC 25923,
BPB NT-38496ES & RPEQ 4541