

# Euro-Truss (UK) Ltd

Consulting Structural Engineers

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## TIMBER FRAME STRUCTURAL CALCULATIONS FOR WORK ABOVE THE SOLEPLATE LEVEL, NOT INCLUSIVE OF FOUNDATIONS

### Client

Tony Fleming  
Kirthenwood Haven  
Bosence Road  
Townshend  
Hayle TR27 6AJ

### Project

South West Solar Solutions  
Mobile Stage

### Job No

ET9050

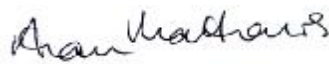
### Date of Issue

29.07.09

### Note

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<b>AB MATTHEWS</b> CEng, MICE

<b>CHARTERED ENGINEER</b> ICE Membership No. 42038927

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ED - 1	B1 (Astralite)	Astralite 3 Truss
ED - 2	B2 (Astralite)	Astralite 3 Truss
ED - 3	B3	76.1x3.2 mm CHS
ED - 4	Stage Deck	
ED - 5	Deck Support Beam	50x30 RHS 4 (rotated)
ED - 16	Deck Leg	48.3x3.2 mm CHS

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	Subject Contents		Title Mobile Stage	
	Date 29.07.09	Sheet	Revision	Job No ET9050

**NOTES - Complying with the Requirements of BS 5268 : Section 6.1 : 1996**

The following structural calculations have been prepared in accordance with the following codes

BS 648 :1964	Schedule of Weights of Building materials
BS 5950-1: 2000	Structural Use of Steelwork in Building.
BS6399 Part 1: 1996	Code of Practice for Dead & Imposed Loads
BS6399 Part 2: 1997	Code of Practice for Wind Loads
BS EN 1991-1-1:2007	Design of Aluminium Structures

**Structural Stability**

**Horizontal Direction**

The building is designed as a platform frame construction using walls to give wind racking resistance in the form of shear walls.

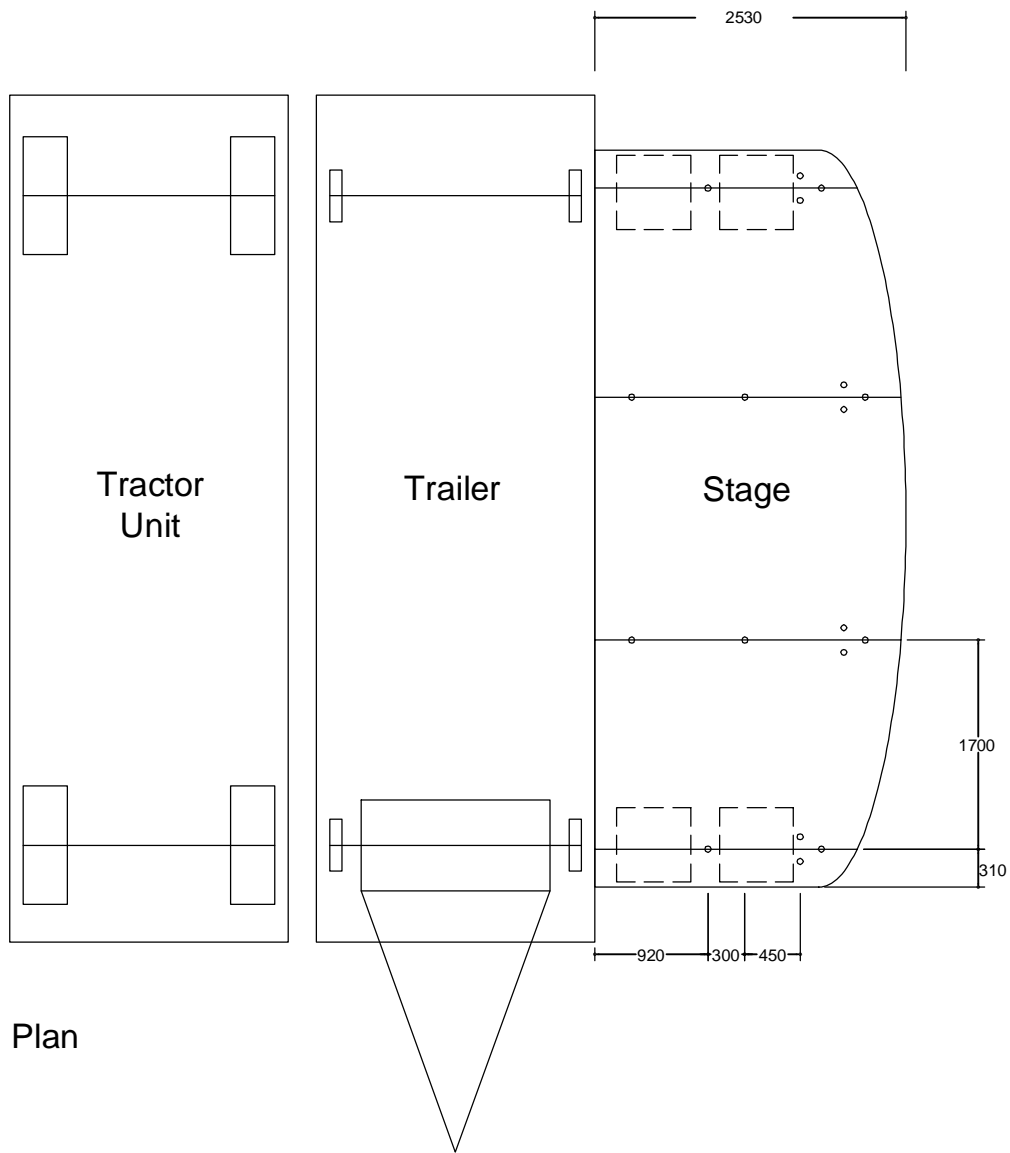
The general stability of the building is analysed for both overturning and sliding and checked for a minimum factor of safety of 1.2.

To minimise lateral wind forces on the trailer unit the tractor unit will be parked behind the trailer thus protecting the long face from leeward forces.

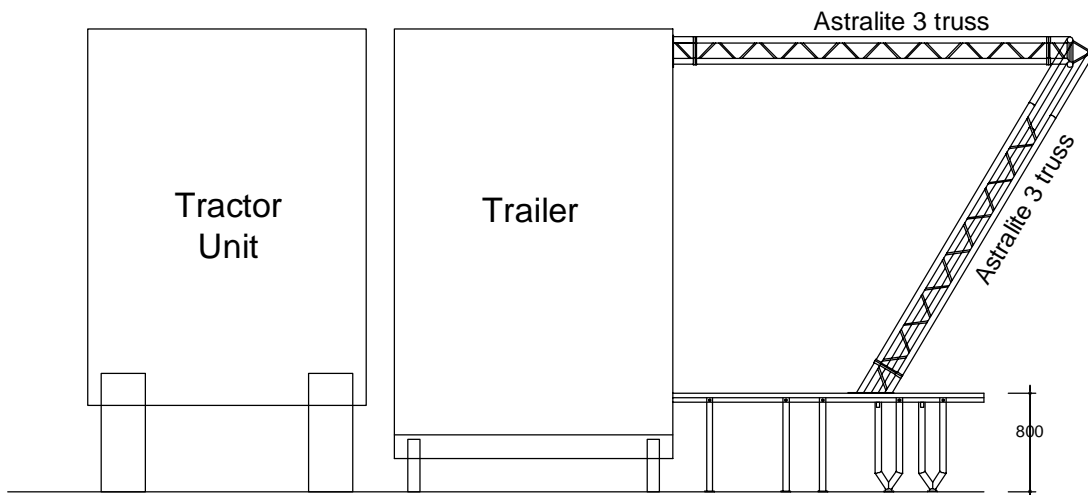
**Vertical Direction**

It is necessary to provide kentledge to withstand the upward forces induced by the wind upon the canopy above the stage. Kentledge is also provided within the trailer unit to resist lateral wind forces imposed on the trailer unit.

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	Subject General Notes		Title Mobile Stage	
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Plan



Side Elevation

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Client  
 Tony Fleming

Subject  
 General Arrangement

Date  
 29.07.09

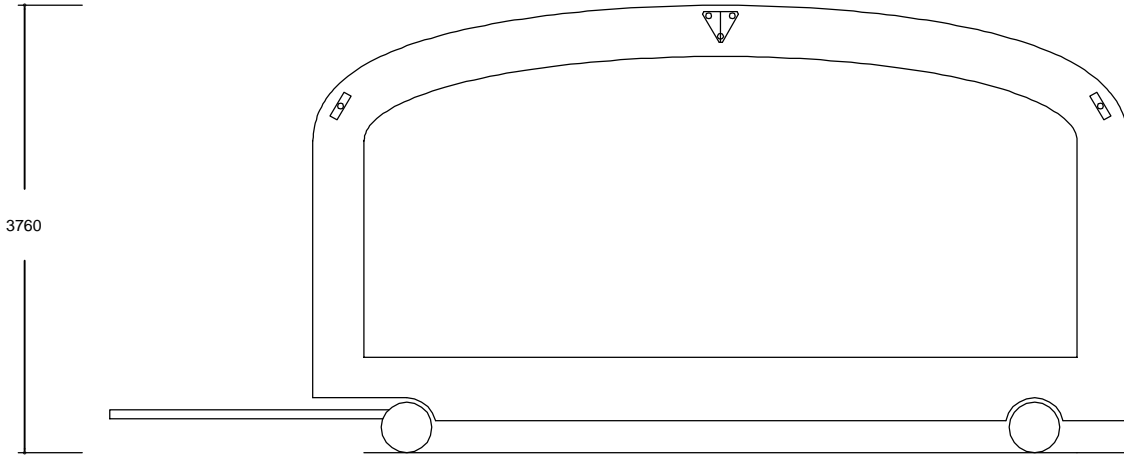
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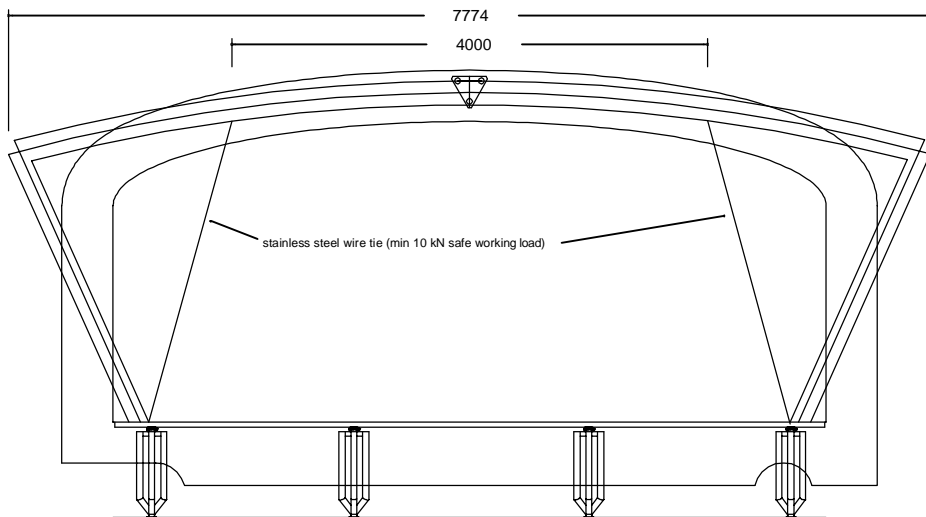
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Front Elevation



Front Elevation (showing stage & canopy support)

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 South West Solar Solutions

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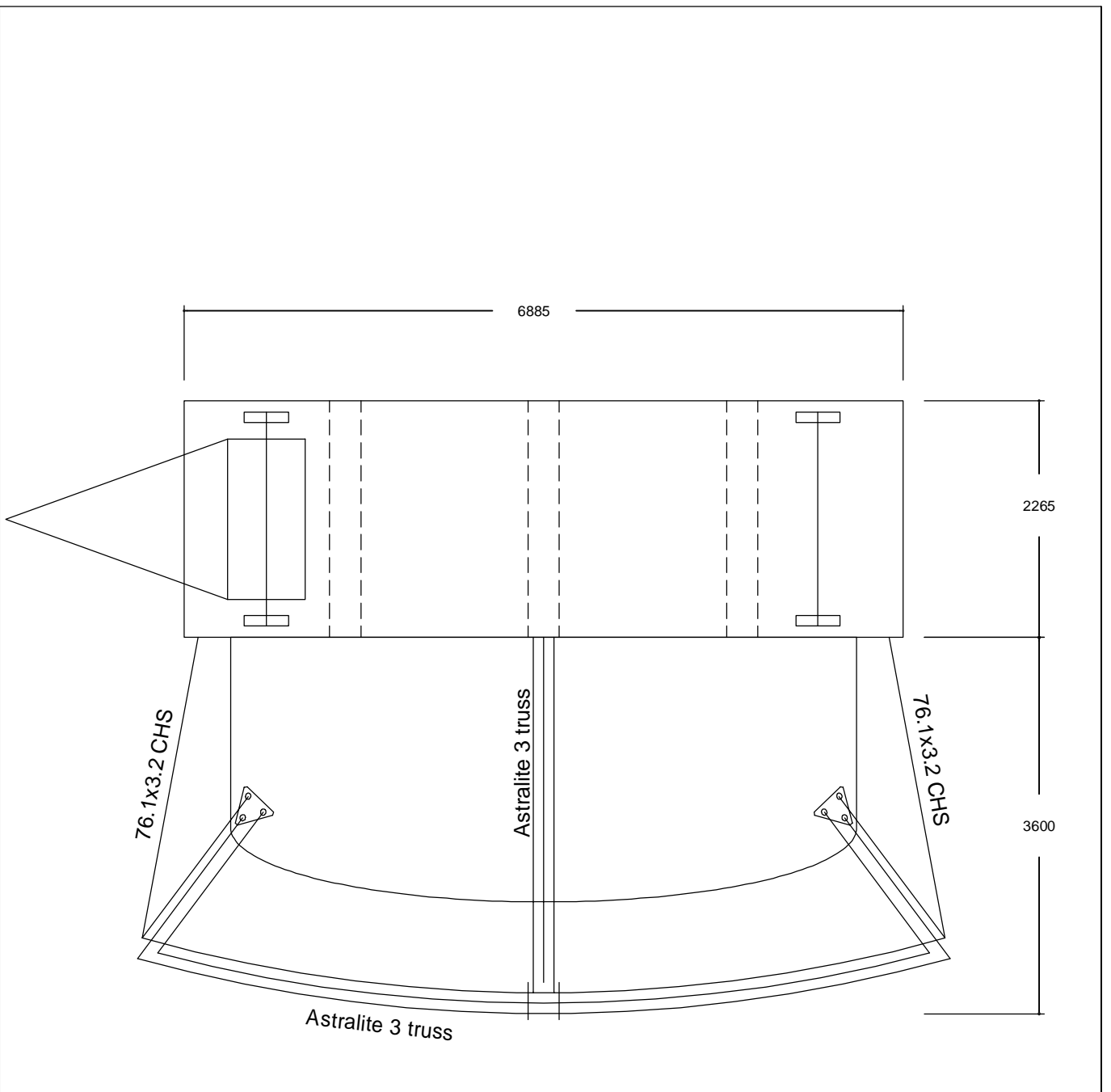
Title  
 Mobile Stage

Date  
 29.07.09

Sheet  
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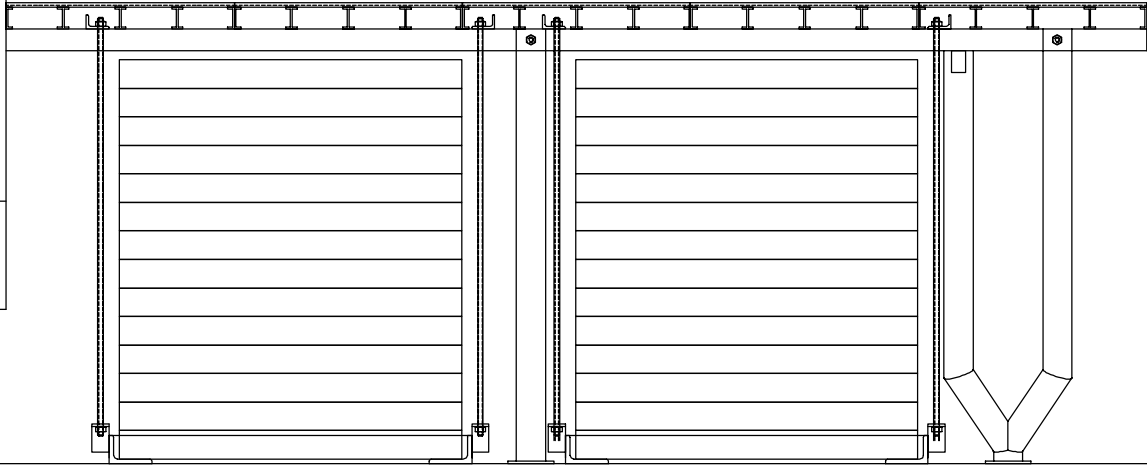
Revision

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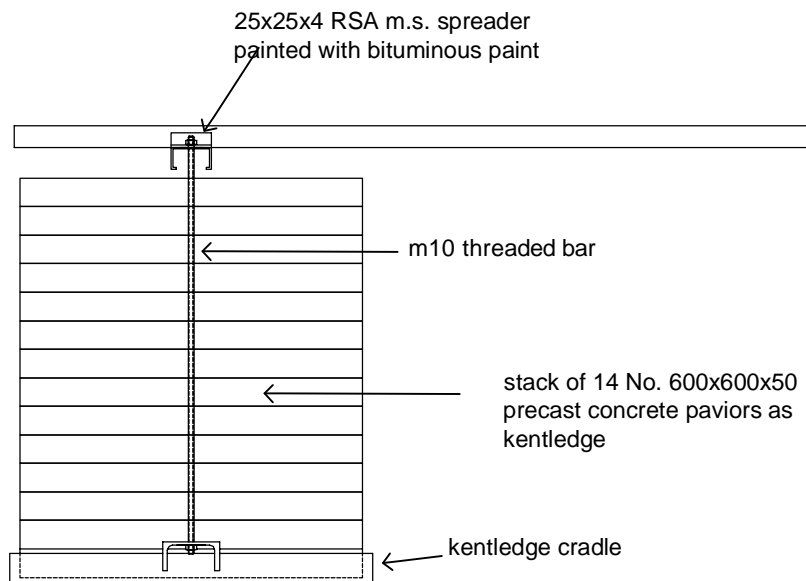


Plan (showing canopy support)

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Side View



Front View

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Subject  
 Under Stage Kentledge Detail

Title  
 Mobile Stage

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 29.07.09

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Revision

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 ET9050

**General Loading**

<b>Roof</b>	Live		<b>0.600</b> kN/m <sup>2</sup>
	Metal Profile	0.070	
	Insulation	<u>0.030</u>	
		<b>0.100</b>	

**External Walls**

	Metal Profile	0.070	
	Insulation	<u>0.030</u>	
		<b>0.100</b> kN/m <sup>2</sup>	

**Astralite 3 Trussing** 0.030 kN/m

**Stage Decking**

	Live		<b>5.000</b> kN/m <sup>2</sup>
	Dead	<b>0.210</b> kN/m <sup>2</sup>	

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South West Solar Solutions

Subject  
Loading

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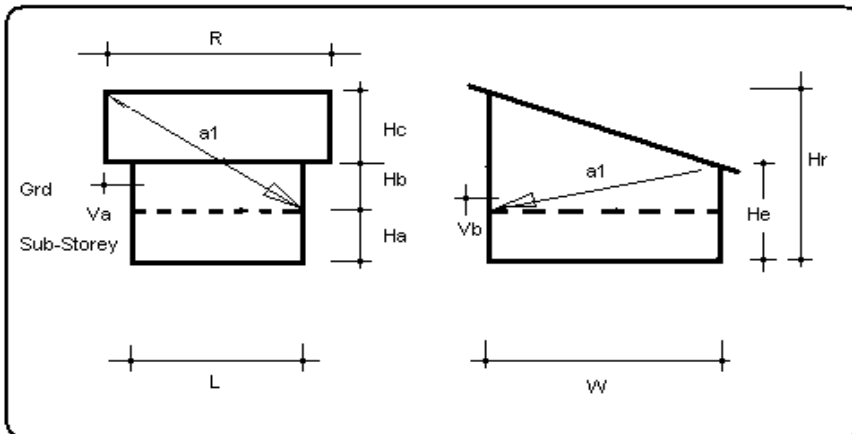
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Reference to BS 6399 : Part 2 : 1997 - Code of Practice for Wind Loads in  
 particular Section 2 - Standard Method  
 Geometry (m)



$\theta = 0^\circ$   
 $R = 6.855$   
 $L = 6.855$   
 $W = 2.265$   
 $rd = 0.000$   
 $Ha = 0.000$   
 $Hb = 3.413$   
 $Hc = 0.000$   
 $He = 3.413$   
 $Hr = 3.413$   
 $Va = 0.000$   
 $Vb = 0.000$

o/a depth of 1st floor = 0 m

**Dynamic Clarification**

Clause	Item	Value
1.3.3.2	Building height	$H_{eav} = 3.413$ m
1.6.1	from Table 1	$K_b = 0.5$
1.6.1	from Figure 3	$Cr = 0.005756$
1.6.2 + C.1.4	Check $Cr < 0.25$	OK BS 6339 can be used

**Site Particulars**

Dist to sea = 5 km  
 Site Category = Country  
 Height above sea level =  $H_s = 20$  m  
 Lowest obstruction height (Clause 1.3.3.4) =  $H_o = 0$  m  
 From Fig 6, page 13 basic wind speed  $V_b = 21$  m/s

Clause 1.7.3.3  $H_o = 0$  m  $X_o = 0$  m  
 $He' = 3.413$  m

Clause 2.2.2.2.1 reference to Fig 7 there is no significant topography, hence using  $S_a = 1 + 0.00H_s$   $S_a = 1.02$

Clause 2.2.2.4  $S_s = 1$

Clause 2.2.2.5  $S_p = 1$

Clause 2.2.2.3  $S_d = 1$

Clause 2.2.2.1 gives the site wind speed  $V_s = V_b \times S_a \times S_d \times S_s \times S_p = 21.4$  m/sec

$S_b = 1.48487$

$V_e = V_s \times S_b = 31.81$  m/s

Dynamic wind pressure,  $q_s = 0.613 \times V_e^2 = 0.620$  kN/m<sup>2</sup> .....Clause 2.1.2.1

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	Subject Wind Analysis - Basic Wind Pressure	Title Mobile Stage	
	Date 29.07.09	Sheet WN - 1	Revision

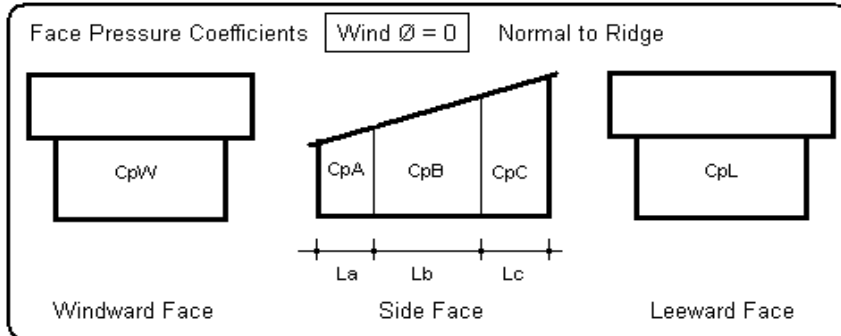
**Pressure coefficients for wind on walls**

Scaling dimension Parallel to ridge

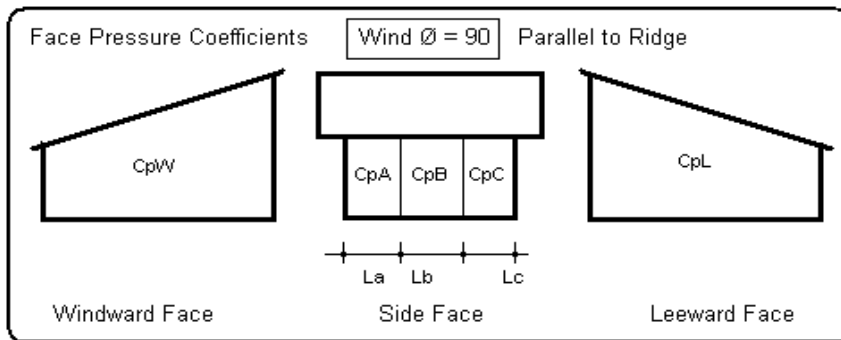
Clause	Item	Value
1.3.3.2	H	3.413
1.3.4.3	B	2.265
1.3.4.4	D	6.855
2.2.3.2	Hr	3.413
2.4.1.2	D/H	2.008
2.4.1.3	b	6.855
2.4.1.4	funnelling is not applicable	

Normal to ridge

Item	Value
H	3.413
B	6.855
D	2.265
Hr	3.413
D/H	0.664
b	2.265



CpW	0.78
CpA	-1.30
CpB	-0.72
CpC	0.00
CpL	-0.49
La	1.371 m
Lb	0.894
Lc	0.000

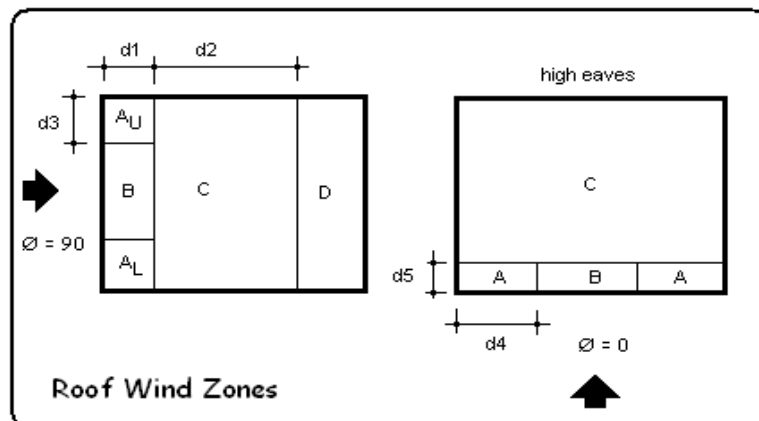


CpW	0.73
CpA	-1.30
CpB	-0.78
CpC	-0.40
CpL	-0.50
La	0.453 m
Lb	6.373
Lc	0.029

**Roof pressure coefficients**

Scaling dimensions

Clause	Wind $\theta = 90$		Wind $\theta = 0$	
	Item	Value	Item	Value
1.3.3.2	Hr	3.413	Hr	3.413
1.3.4.3	B	2.265	B	6.855
2.5.2.2	bw	2.265	bL	6.826



d1	0.227 m
d2	0.906
d3	0.566
d4	1.707
d5	0.683

**Roof Coefficients**

Zone	$\theta = 0$		$\theta = 90$
A/A <sub>U</sub>	-2.00	0.00	-2.00
A <sub>L</sub>			-2.00
B	-1.40	0.00	-1.40
C	-0.69	0.00	-0.70
D			-0.20

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Subject  
 Wind Analysis - Pressure Coefficients

Date  
 29.07.09

Sheet  
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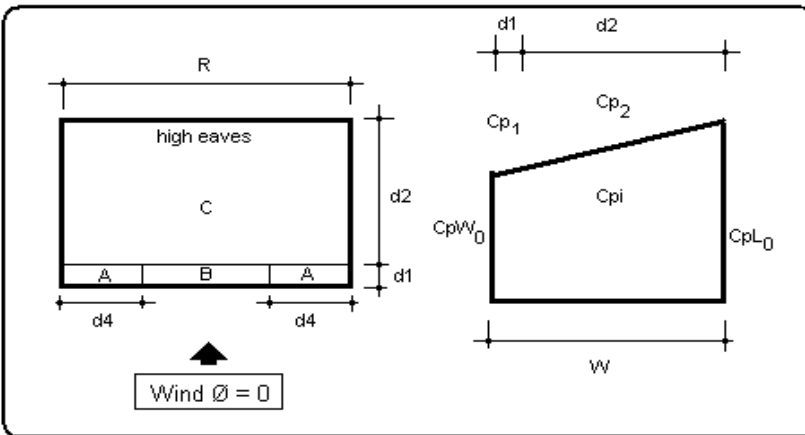
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**Roof uplift check (+ve Cpi) Wind  $\theta = 0$**



R 6.855  
W 2.265

		A	B
d1	0.683	Cp1	-2.00
d2	1.582	Cp2	-1.40
d3	0.000	Cp3	
d4	0.227		

CpW<sub>0</sub> 0.800  
CpL<sub>0</sub> -0.500  
Cpi 0.800

NB Roof pressures are vector combination of cpe + cpi

Roof area lever arms about rear wall  
 d1 d2 d3  
 zone width = 0.683 1.582 0.000  
 1.924 0.791 0.000  
 Roof area lever arms about front wall  
 0.341 1.474 2.265

Roof uplift check (moments about rear wall)

Item	P kN/m <sup>2</sup>		Area	Vert Ld		L. arm	Moment		Horz Ld	
	-ve	+ve		-ve	+ve		-ve	+ve	-ve	+ve
Wind A x 2no areas	-1.436	-0.376	2.33	-3.35	-0.88	1.92	-6	-1.7	0.00	0.00
Wind B	-1.118	-0.376	2.35	-2.63	-0.88	1.92	-5.1	-1.7	0.00	0.00
Wind C	-0.739	-0.376	10.85	-8.02	-4.08	0.79	-6.3	-3.2	0.00	0.00
LeeFace	0.19		0						0.00	0.00
Totals				-13.99	-5.84		-18	-6.6	0.00	0.00

Totals  
 Roof dead resisting 0.100 15.53 1.55 1.13 2 (a)  
**Net reaction at support(front wall) = (a+b)/(LW+2/3W<sup>2</sup>) -0.85 -0.26 kN/m <--- Uplift**  
 use on front wall load assessment for K107

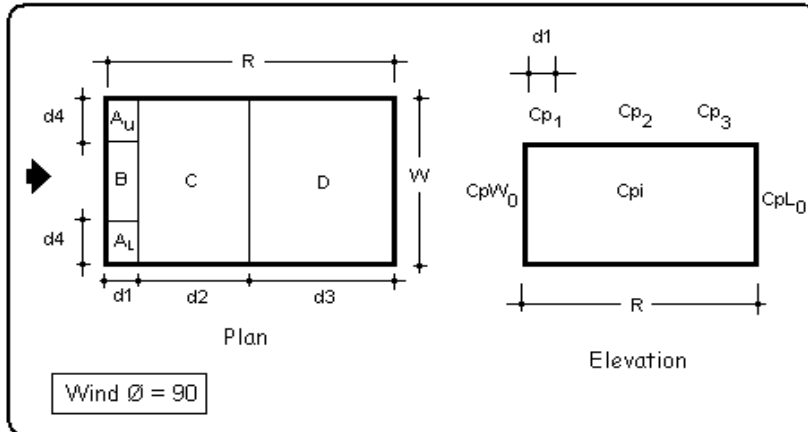
Roof uplift check (moments about front wall)

Wind A x 2no areas	-1.436	-0.376	2.33	-3.35	-0.88	0.34	-1.1	-0.3
Wind B	-1.118	-0.376	2.35	-2.63	-0.88	0.34	-0.9	-0.3
Wind C	-0.739	-0.376	10.85	-8.02	-4.08	1.47	-12	-6.0
Totals				-13.99	-5.84		-14	-6.6

Totals  
 Roof 0.100 15.53 1.55 1.13 2 (a)  
**Net reaction at support(rear wall) = (a+b)/(LW+2/3W<sup>2</sup>) -0.64 -0.26 kN/m <--- Uplift**  
 use on rear wall load assessment for K107

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	Subject Wind Analysis -Uplift (Wind $\theta = 0$ )	Title Mobile Stage		
	Date 29.07.09	Sheet WN - 3	Revision	Job No ET9050

**Roof uplift check (+ve Cpi) Wind  $\theta = 90$**



R 6.855  
W 2.265

			A <sub>L</sub>	A <sub>U</sub>	B
d1	0.227	Cp1	-2.00	-2.00	-1.40
d2	0.906	Cp2	-0.70		
d3	5.723	Cp2	-0.20		
d4	0.566				

CpW<sub>0</sub> 0.733  
CpL<sub>0</sub> -0.500  
Cpi 0.800

NB Roof pressures are vector combination of cpe + cpi

Roof area lever arms about RH gable			
	d1	d2	d3
zone width	0.227	0.906	5.723
cg lever arm	6.742	6.176	2.861
Roof area lever arms about LH gable			
cg lever arm	0.113	0.680	3.994

**Roof uplift check (moments about RH wall)**

Item	P kN/m <sup>2</sup>		Area	Vert Ld		L. arm	Moment	
	-ve	+ve		-ve	+ve		-ve	+ve
A <sub>U</sub>	-1.436	-0.376	0.13	-0.18	-0.05	6.74	-1	-0.3
A <sub>L</sub>	-1.436	-0.376	0.13	-0.18	-0.05	6.74	-1.2	-0.3
B	-1.118	-0.376	0.26	-0.29	-0.10	6.74	-1.9	-0.6
C	-0.739	-0.376	2.05	-1.52	-0.77	6.18	-9	-4.8
D	-0.480	-0.272	12.96	-6.22	-3.53	2.86	-18	-10.1
Totals				-2.17	-0.96		-14	-6.1
Roof dead resisting	0.100		15.53	1.55		3.43	5	

**Net Reaction at support(LH wall) = (a+b)/(WL+2/3L<sup>2</sup>)**      **-0.18    -0.02 kN/m <--- Uplift**  
use on front wall load assessment for K107

**Roof uplift check (moments about LH wall)**

A <sub>U</sub>	-1.436	-0.376	0.13	-0.18	-0.05	0.11	-0.02	-0.01
A <sub>L</sub>	-1.436	-0.376	0.13	-0.18	-0.05	0.11	-0.02	-0.01
B	-1.118	-0.376	0.26	-0.29	-0.10	0.11	-0.03	-0.01
C	-0.739	-0.376	2.05	-1.52	-0.77	0.68	-1.0	-0.52
D	-0.480	-0.272	12.96	-6.22	-3.53	3.99	-25	-14.08
Totals				-8.39	-4.49		-26	-14.6
Roof	0.100		15.53	1.55		3.43	5	

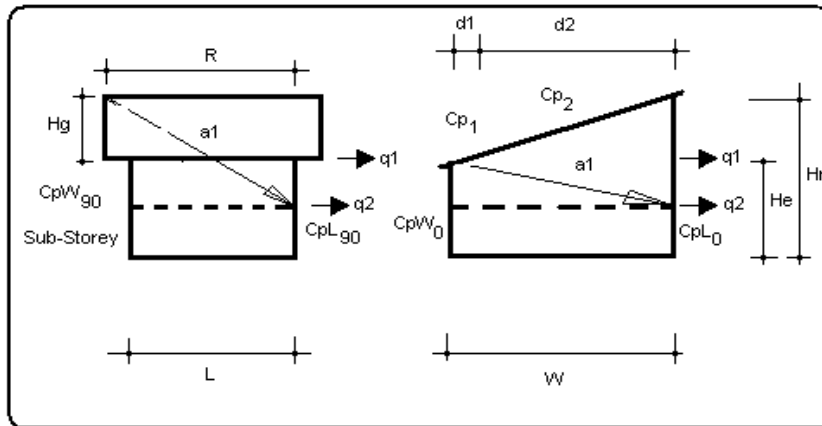
**Net reaction at support(RH wall) = (a+b)/(WL+2/3L<sup>2</sup>)**      **-0.44    -0.20 kN/m <-- Uplift**  
use on rear wall load assessment for K107

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	Subject Wind Analysis -Uplift (Wind $\theta = 90$ )	Title Mobile Stage		
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## Racking forces

Rf slope =

0 °



R 6.86 m  
Hg 0.000 m  
He 3.413 m  
Hr 3.413 m

L 6.86 m  
W 2.265 m

CpW<sub>90</sub> 0.733  
CpL<sub>90</sub> -0.500  
CpW<sub>0</sub> 0.800  
CpL<sub>0</sub> -0.500

		a1
<b>Length of building</b>	Height	3.413
	Clause 2.1.3.4	Diag. 7.658
		Ca 0.973
<b>Width of building</b>	Height	3.413
	Clause 2.1.3.4	Diag. 4.096
		Ca 1.000

### Wind Ø = 90

		q1	q2
windward	exposure factor	1	1
	area	3.413	3.865
	Ca	0.973	0.973
	qs*CpW <sub>90</sub> *0.85*(1+Cr)	0.388	0.388
	Wind shear	<b>1.291</b>	<b>1.462</b>
Leeward	exposure factor	1	1
	qs*CpL <sub>90</sub> *0.85*(1+Cr)	0.265	0.265
	Wind shear	<b>0.881</b>	<b>0.997</b>
	Windward + Leeward	<b>2.17</b>	<b>2.46</b>
	Cumulative		
Windward + Leeward (ii)	<b>3.75</b>	<b>6.21</b>	
Windward only(i)	<b>1.29</b>	<b>2.75</b>	

### Wind Ø = 0

		q1	q2
windward	exposure factor	1	1
	area	11.698	11.698
	Ca	1.000	1.000
	qs*CpW <sub>90</sub> *0.85*(1+Cr)	0.388	0.388
	Roof Shear	0.00	
Wind shear	<b>4.544</b>	<b>4.544</b>	
Leeward	exposure factor	0	0
	qs*CpL <sub>90</sub> *0.85*(1+Cr)	0.265	0.265
	Wind shear	<b>0.000</b>	<b>0.000</b>
	Windward + Leeward	<b>4.54</b>	<b>4.54</b>
	Cumulative		
Windward + Leeward (ii)	<b>9.09</b>	<b>13.63</b>	
Windward only(i)	<b>4.54</b>	<b>9.09</b>	

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Client  
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Subject  
Wind Analysis - Racking Forces

Date  
29.07.09

Sheet  
WN - 5

Project  
South West Solar Solutions

Title  
Mobile Stage

Revision

Job No  
ET9050

**Stability check**

**Wind Ø = 0**

Wind shear		L. arm	Moment
Roof Uplift	-13.989	1.1325	15.8425
<b>q1</b>	4.54	3.413	15.51
<b>q2</b>	4.54		
<b>Total</b>	<b>9 kN</b>		<b>31 kN.m</b>

	kN.m <sup>2</sup>	Area	Red fact	Force	L arm	Moment
Roof Uplift				-13.99		
Trailer Unladen				35.00	1.133	40
Kentledge				10.80	1.133	12
<b>Totals for building</b>				<b>32 kN</b>		<b>40 kN.m</b>

**Stability factors of safety**

Sliding=  $\frac{\text{total vertical load} \times 0.40}{\text{total wind shear load}} = \frac{32 \times 0.4}{9} = 1.40 \geq 1.2 \text{ Ok}$

Overturning =  $\frac{\text{total RM}}{\text{total OTM}} = \frac{40}{31} = 1.26 \geq 1.2 \text{ Ok}$

**Wind Ø = 90**

Wind shear		L. arm	Moment
Roof Uplift	-2.1717	3.4275	7.44348
<b>q1</b>	2.17	3.413	7.41
<b>q2</b>	2.46		
<b>Total</b>	<b>5 kN</b>		<b>15 kN.m</b>

	Pan. ht	kN.m <sup>2</sup>	Area	Red fact	Force	L arm	Moment
Roof Uplift					-13.99		
Trailer Unladen					35.00	3.428	120
Kentledge					10.80	3.428	37
<b>Totals for building</b>					<b>35 kN</b>		<b>120 kN.m</b>

**Stability factors of safety**

Sliding=  $\frac{\text{total vertical load} \times 0.40}{\text{total wind shear load}} = \frac{35 \times 0.4}{5} = 3.02 \geq 1.2 \text{ Ok}$

Overturning =  $\frac{\text{total RM}}{\text{total OTM}} = \frac{120}{15} = 8.08 \geq 1.2 \text{ Ok}$

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	Subject Wind Analysis Stability		Title Mobile Stage	
	Date 29.07.09	Sheet WN - 6	Revision	Job No ET9050

Area of Stage Canopy = 28 m<sup>2</sup>

C<sub>p</sub> = -1.2 (100 % downwind blockage)

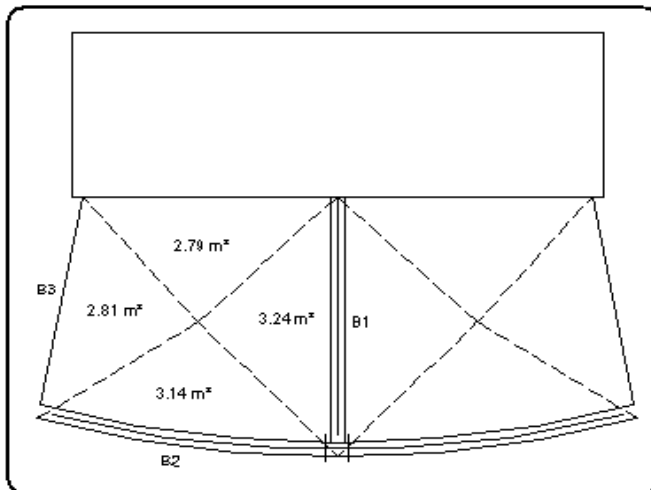
C<sub>a</sub> = 0.9736

Wind pressure = -0.62 x -1.2 x C<sub>a</sub> = -0.724 kN/m<sup>2</sup>

Canopy Uplift = 28 x 0.724 = 20.83 kN

	kN.m <sup>2</sup>	Area	Force
Tarpaulin	0.001	28	0.03
Stage Deck	0.210	15.00	3.15
AstraLite trussing	0.030	17.10	0.51
Kentledge			24.19
<b>Total</b>			<b>27.88 kN</b>

Factor of safety against uplift = 1.34



Beam	Area	P	Load
	m <sup>2</sup>	kN/m <sup>2</sup>	kN
B1	6.48	0.724	4.69
B2	3.14	0.724	2.27
B3	2.81	0.724	2.03

B1 permissible load (UDL) = 210 kg/m (for span = 3.4m)

= 2.1 kN/m

= 7.14 kN

permissible load (triangular) = 5.36 kN > 4.69

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	<p>Subject          B1 (Astralite)</p>	<p>Title          Mobile Stage</p>	
	<p>Date          29.07.09</p>	<p>Sheet          ED - 1</p>	<p>Revision</p>

**B2**

Span = 1925,4000,1925 mm

**Pt Loads (kN)**

Description	ID	loc	Ø	Live
		mm	°	kN
B1 Rct	0	3925	270.0	2.35

**UD Loads (kN/m)**

Description	ID	UDL	dim		start	end	Live	
		kN/m <sup>2</sup>	m	m	mm	mm	kN/m	kN/m
			(1)	(2)			(1)	(2)
Live	1	0.724	0.000	1.732	0	1840	0.000	1.254
Live	2	0.724	1.732	0.000	1840	3925	1.254	0.000
Live	3	0.724	0.000	1.732	3925	6010	0.000	1.254
Live	4	0.724	1.732	0.000	6010	7850	1.254	0.000

**Forces**

Node	dist (mm)	defl (mm)	rot (°)	Mmt (kNm)	shr-L (kN)	shr-R (kN)	RctX (kN)	RctY (kN)
------	--------------	--------------	------------	--------------	---------------	---------------	--------------	--------------

**Loadcase 1 (ID:0,1,2,3,4) Serviceability State**

0	0.0	0.000	0.0159	0.00	0.00	0.32	0.00	-0.32
1	962.5	0.214	0.0059	-0.41	0.63	0.63	0.00	0.00
7	1840.0	0.055	-0.0340	-1.29	1.47	1.47	0.00	0.00
2	1925.0	0.000	-0.0407	-1.42	1.58	-2.38	0.00	3.96
3	3925.0	1.741	0.0000	1.73	-1.18	1.17	0.00	0.00
4	5925.0	0.000	0.0407	-1.42	2.38	-1.58	0.00	3.96
8	6010.0	0.055	0.0340	-1.29	-1.47	-1.47	0.00	0.00
5	6887.5	0.214	-0.0059	-0.41	-0.63	-0.63	0.00	0.00
6	7850.0	0.000	-0.0159	0.00	-0.32	0.00	0.00	-0.32
						<b>0.00</b>		<b>7.27</b>

permissible load = 146.00 kg/m (for span of 4.0m)

= 1.432 kN/m

Mr = wl<sup>2</sup>/8 = 2.86 kNm > 1.73

Max shear = wl/2 = 2.864 kN &gt; 2.38

**Vertical Dead Load**

element	udl	dim	load
tarpaulin	0.001	9.520	0.010
B1	0.030	1.700	0.051
B2	0.030	7.850	0.236
			0.296 kN

= 30.17 kg

permissible load = 14.00 kg/m (for span of 8.0m)

= 110 kg (for span of 7.85m) &gt; 30.17

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Client  
 Tony Fleming

Subject  
 B2 (Astralite)

Date  
 29.07.09

Sheet  
 ED - 2

Project  
 South West Solar Solutions

Title  
 Mobile Stage

Revision

Job No  
 ET9050



B3

Span = 2925.00 mm

**UD Loads (kN/m)**

Description	ID	UDL	dim		start	end	Dead		gF
		kN/m <sup>2</sup>	m	m	mm	mm	kN/m		
			(1)	(2)			(1)	(2)	
Live	0	0.724	0.000	-1.921	0	1463	0.000	-1.391	1.40
Live	1	0.724	-1.921	0.000	1463	2925	-1.391	0.000	1.40
Self Wt	2				0	2925	0.056	0.056	1.40

**Forces**

Node	dist (mm)	defl (mm)	rot (°)	Mmt (kNm)	shr-L (kN)	shr-R (kN)	RctX (kN)	RctY (kN)
------	--------------	--------------	------------	--------------	---------------	---------------	--------------	--------------

**Loadcase 1 (ID:0,1,2) Ultimate Limit State**

0	0.0	0.000	0.6637	0.00	0.00	1.31	0.00	-1.31
1	1462.5	10.861	0.0000	-1.30	0.00	0.00	0.00	0.00
3	1463.0	10.861	-0.0003	-1.30	0.00	0.00	0.00	0.00
2	2925.0	0.000	-0.6638	0.00	-1.31	0.00	0.00	-1.31
						<b>0.00</b>		<b>-2.62</b>

**Loadcase 1 (ID:0,1,2) Serviceability State**

0	0.0	0.000	0.4741	0.00	0.00	0.94	0.00	-0.94
1	1462.5	7.758	0.0000	-0.93	0.00	0.00	0.00	0.00
3	1463.0	7.758	-0.0002	-0.93	0.00	0.00	0.00	0.00
2	2925.0	0.000	-0.4741	0.00	-0.94	0.00	0.00	-0.94
						<b>0.00</b>		<b>-1.87</b>

**Section 76.1x3.2 mm CHS**

Area	7.3	cm <sup>2</sup>
E	210000	N/mm <sup>2</sup>
I	49	cm <sup>4</sup>
Zx	12.8	cm <sup>3</sup>
Zy	12.8	cm <sup>3</sup>
Sx	17.0	cm <sup>3</sup>
Section class	1.0	
Le/ry=3662.2/25.80	141.946	
Mcx=py.Sxx	4.7	kNm
Mx,MLT	1.30	kNm
Mx/Mr	0.279	..cl 4.8.2.2
mLT	0.733	
pb	74	N/mm <sup>2</sup>
Mb	1.3	kNm
mLT.MLT/Mb	0.757	..cl 4.8.3.3 Lat. Tors. Buckling
Deflection coeff	377	>360(Serviceability State)
No Web Stiffener Required		
shear,Q	1.3	kN
D	76.2	mm
t	3.20	mm
Q/(D.t)	5.37	N/mm <sup>2</sup>

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	Subject B3		Title Mobile Stage	
	Date 29.07.09	Sheet ED - 3	Revision	Job No ET9050

### Stage Deck

Span = 1700,1975,1700 mm

#### UD Loads (kN/m)

Description	ID	mbr	dim	UDL	start	end	Dead	Live	gF
			m	kN/m <sup>2</sup>	mm	mm	kN/m	kN/m	
Live	0	0-5	0.100	5.000	0	5375		0.500	1.60
Dead	1	0-5	0.100	0.210	0	5375	0.021		1.40

#### Forces

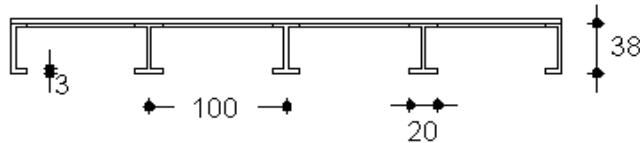
Node	dist	defl	rot	Mmt	shr-L	shr-R	RctX	RctY
	(mm)	(mm)	(°)	(kNm)	(kN)	(kN)	(kN)	(kN)

#### Loadcase 1 (ID:0,1) Ultimate Limit State

0	0.0	0.000	-1.6424	0.00	0.00	-0.54	0.00	0.54	
1	850.0	12.548	0.3615	0.16	0.17	0.17	0.00	0.00	
2	1700.0	0.000	0.1966	-0.28	0.87	-0.82	0.00	1.69	
3	2687.5	8.738	0.0000	0.12	0.00	0.00	0.00	0.00	
4	3675.0	0.000	-0.1966	-0.28	0.82	-0.87	0.00	1.69	
5	4525.0	12.548	-0.3615	0.16	-0.17	-0.17	0.00	0.00	
6	5375.0	0.000	1.6424	0.00	0.54	0.00	0.00	0.54	
								<b>0.00</b>	<b>4.46</b>

#### Loadcase 1 (ID:0,1) Serviceability State

0	0.0	0.000	-1.0317	0.00	0.00	-0.34	0.00	0.34	
1	850.0	7.882	0.2271	0.10	0.10	0.10	0.00	0.00	
2	1700.0	0.000	0.1235	-0.18	0.55	-0.51	0.00	1.06	
3	2687.5	5.489	0.0000	0.08	0.00	0.00	0.00	0.00	
4	3675.0	0.000	-0.1235	-0.18	0.51	-0.55	0.00	1.06	
5	4525.0	7.882	-0.2271	0.10	-0.10	-0.10	0.00	0.00	
6	5375.0	0.000	1.0317	0.00	0.34	0.00	0.00	0.34	
								<b>0.00</b>	<b>2.80</b>



#### Section 38x20x3 Alum-Alloy I

Area	2.2	cm <sup>2</sup>
E	70000	N/mm <sup>2</sup>
I	5	cm <sup>4</sup>
Zx	2.37	cm <sup>3</sup>
Zy	0.4	cm <sup>3</sup>
Section class	1.0	

V <sub>ED</sub>	0.87	kN
A <sub>v</sub> = 3 x 38	= 114	mm <sup>2</sup>
V <sub>RD</sub> = 114x110/1.1/√3	= 6582.0	N (Av.f <sub>0</sub> /g <sub>M1/√3</sub> )
V <sub>ED</sub> /V <sub>RD</sub>	= 0.195	
M <sub>ED</sub>	= 0.280	kNm
M <sub>RD</sub> = 2370x180/1.25	= 0.341	kNm (Zx.fu/g <sub>M2</sub> )
M <sub>ED</sub> /M <sub>RD</sub>	= 0.821	< 1.0

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Client  
 Tony Fleming

Subject  
 Stage Deck

Date  
 29.07.09

Sheet  
 ED - 4

Project  
 South West Solar Solutions

Title  
 Mobile Stage

Revision

Job No  
 ET9050

Span = 300,912,806,200,c291 mm

**UD Loads (kN/m)**

Description	ID	mbr	dim	UDL	start	end	Dead	Live	gF
			m	kN/m <sup>2</sup>	mm	mm	kN/m	kN/m	
Live	0	0-9	2.030	5.000	0	2509		10.150	1.60
Dead	1	0-9	2.030	0.021	0	2509	0.043		1.40
Self Wt	2	0-9			0	2509	0.041		1.40

**Forces**

Node	dist	defl	rot	Mmt	shr-L	shr-R	RctX	RctY
	(mm)	(mm)	(°)	(kNm)	(kN)	(kN)	(kN)	(kN)

**Loadcase 1 (ID:0,1,2) Ultimate Limit State**

0	0.0	0.000	0.1060	0.00	0.00	0.51	0.00	-0.51
1	150.0	0.233	0.0453	-0.26	2.96	2.96	0.00	0.00
2	300.0	0.000	-0.2871	-0.89	5.41	-7.16	0.00	12.57
3	756.0	2.902	0.0425	0.68	0.30	0.30	0.00	0.00
4	1212.0	0.000	0.1171	-1.16	7.76	-7.36	0.00	15.12
5	1615.0	1.461	-0.0844	0.47	-0.76	-0.76	0.00	0.00
6	2018.0	0.000	0.2204	-0.55	5.83	-0.90	0.00	6.73
7	2118.0	0.196	0.0050	-0.54	0.73	0.73	0.00	0.00
8	2218.0	0.000	-0.2403	-0.69	2.37	-4.76	0.00	7.13
9	2363.5	0.980	-0.4800	-0.17	-2.38	-2.38	0.00	0.00
10	2509.0	2.264	-0.5143	0.00	0.00	0.00	0.00	0.00
							<b>0.00</b>	<b>41.04</b>

**Loadcase 1 (ID:0,1,2) Serviceability State**

0	0.0	0.000	0.0663	0.00	0.00	0.32	0.00	-0.32
1	150.0	0.146	0.0283	-0.16	1.85	1.85	0.00	0.00
2	300.0	0.000	-0.1796	-0.56	3.39	-4.48	0.00	7.87
3	756.0	1.815	0.0266	0.42	0.19	0.19	0.00	0.00
4	1212.0	0.000	0.0733	-0.73	4.85	-4.60	0.00	9.46
5	1615.0	0.914	-0.0528	0.30	-0.48	-0.48	0.00	0.00
6	2018.0	0.000	0.1379	-0.34	3.65	-0.57	0.00	4.21
7	2118.0	0.123	0.0031	-0.34	0.46	0.46	0.00	0.00
8	2218.0	0.000	-0.1503	-0.43	1.48	-2.98	0.00	4.46
9	2363.5	0.613	-0.3003	-0.11	-1.49	-1.49	0.00	0.00
10	2509.0	1.416	-0.3217	0.00	0.00	0.00	0.00	0.00
							<b>0.00</b>	<b>25.68</b>

<b>Section</b>	<b>50x30 RHS 4 (rotated)</b>
Area	5.3 cm <sup>2</sup>
E	210000 N/mm <sup>2</sup>
I	7 cm <sup>4</sup> (minor axis)
Zx	4.5 cm <sup>3</sup>
Zy	6.1 cm <sup>3</sup>
Sx	8.1 cm <sup>3</sup>
Section class	1.0
Le/ry=912.0/11.20	53.964
Mcx=py.Sxx	2.2 kNm
Mx,MLT	1.16 kNm
Mx/Mr	0.757 ..cl 4.8.2.2
Deflection coeff	501.4 >360(Serviceability State)
No Web Stiffener Required	
shear,Q	7.8 kN
D	30.0 mm
t	4.00 mm
Q/(D.t)	64.66 N/mm <sup>2</sup>

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	<p>Subject Deck Support Beam</p>		<p>Title Mobile Stage</p>	
	<p>Date 29.07.09</p>	<p>Sheet ED - 5</p>	<p>Revision</p>	<p>Job No ET9050</p>

Span = 800.000 mm

Pitch = 90.00°

## Axial Loads (kN)

Description	ID	Type	Dead	Live	gF
			kN	kN	
Live	0	comp		9.38	1.60
Dead	1	comp	0.08		1.40
SELF WT	2	comp	0.03		1.40

## Forces

Node	dist	defl	rot	Mmt	shr-L	shr-R	RctX	RctY
	(mm)	(mm)	(°)	(kNm)	(kN)	(kN)	(kN)	(kN)

## Loadcase 1 (ID:0,1,2) Ultimate Limit State

0	0.0	0.000	0.0000	0.00	0.00	0.00	0.00	15.16
1	400.0	0.000	0.0000	0.00	0.00	0.00	0.00	0.00
2	800.0	0.000	0.0000	0.00	0.00	0.00	0.00	0.00
							<b>0.00</b>	<b>15.16</b>

## Loadcase 1 (ID:0,1,2) Serviceability State

0	0.0	0.000	0.0000	0.00	0.00	0.00	0.00	9.49
1	400.0	0.000	0.0000	0.00	0.00	0.00	0.00	0.00
2	800.0	0.000	0.0000	0.00	0.00	0.00	0.00	0.00
							<b>0.00</b>	<b>9.49</b>

## Section

## 48.3x3.2 mm CHS

Area	4.5	cm <sup>2</sup>
E	210000	N/mm <sup>2</sup>
I	12	cm <sup>4</sup>
Zx	4.8	cm <sup>3</sup>
Zy	4.8	cm <sup>3</sup>
Sx	6.5	cm <sup>3</sup>
Section class	3.0	

Axial (comp -ve)	-15.2	kN
Le/ry=800.0/16.00	50.000	
Mcx=py.Zxx	1.3	kNm
P=A.pc=453x220.9	100	kN
Mx,MLT	0.000	kNm
F/P+Mx/Mr	0.151	..cl 4.8.2.2
mx	1.000	
F/P+mx.Mx/py/Zx	0.151	..cl 4.8.3.3 (Flex. Buckling)
mLT	1.000	
pb	239	N/mm <sup>2</sup>
Mb	1.1	kNm
F/P+mLT.MLT/Mb	0.151	..cl 4.8.3.3 Lat. Tors. Buckling

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 29.07.09

Sheet  
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Project  
 South West Solar Solutions

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 Mobile Stage

Revision

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