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14x3.6MT BUILDING

PORT ALBERT MARITIME MUSEUM

COMPUTATION REPORT

25 July 2024

ANALYSIS FOR STABILITY/OVERTURNING

WIDTH(mt)	HEIGHT(mt)	LENGTH(mt)
3.6	3	14

ROOF	WALLS
75	50

REGION **A**
TC **2**
Str. Importance Level **3**
Shielding Condition ◉ No Shielded ○ Partially Shielded ○ Fully Shielded

WIND LOADS (AS 1170.2-2002)

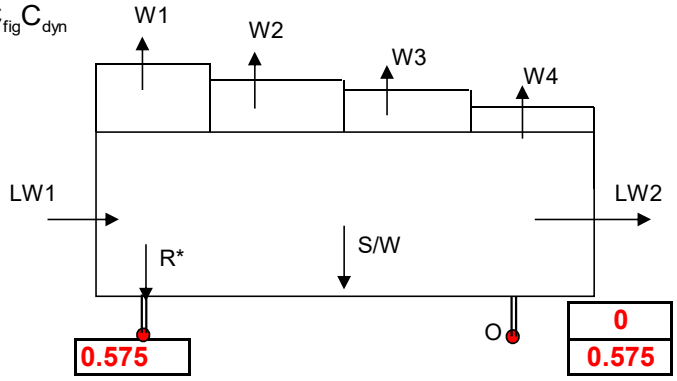
Site Wind Speed $V_{sit,\beta} = V_R M_d (M_{z,cat} M_s M_t)$

Return Period (R)	$V_{sit,\beta}$	$V_{des,\theta}$	V_R	M_d	$M_{z,cat}$	M_s	M_t
500	37	37	45	1	0.83	1	1

Design Wind Pressure $p = (0.5\rho_{air})[V_{des,\theta}]^2 C_{fig} C_{dyn}$

$C_{fig} = C_{p,e} K_a K_c K_l K_p$

C_{dyn}	1	
ρ_{air}	1.2	
K_a	1	
K_l	1	
K_c	**0.8**	
K_p	1	
p_z =	0.84	kPa



Vertical Wind		$C_{p,e}$	$C_{p,i}$	C_{fig}	p(kPa)	W(kN/m)	d(m)	Mts(kNm)
0-1h	3	0.9	0	0.72	0.60	1.81	0.9	1.67
1h-2h	0	0	0	0	0.00	0.00	0.0	0.00
2h-3h	0	0	0	0	0.00	0.00	0.0	0.00
>3h	0	0	0	0	0.00	0.00	0.0	0.00
							Σ	1.67

Horizontal Wind		$C_{p,e}$	$C_{p,i}$	C_{fig}	p_z	LW		
LW1		0.7	0	0.56	0.47	1.40	1.5	2.11
LW2		0.5	0	0.40	0.33	1.00	1.5	1.51
Moment about O (per m)					Σ	2.41		3.61
M_o =	5.28	kNm						5.28

Resisting Moment about O (per m)

S/W	**0.77**	kPa
DL	2.31	kN/m
$0.9M_R$ =	1.92	kNm
R_u =	1.82	kN
Anchor Spacing	**6.5**	m
Required Anchorage/Anchor R_u =	11.80	kN

Warning! Anchorage to be Provided

USE DB-88 EARTH ANCHOR DUCKBILL

BUILDING WEIGHTS

Width	3.6				
Length	14				
Height	3				
ROOF	kg/m^2		tones	kPa	
Panel	12.3	36	0.44	0.12	
WALL				kN/m	
panel	11.6	90	1.04	0.35	
FLOOR					
Vinyl	2.75	36	0.10		
Particle Board	15.4	36	0.55		
BASE FRAMING					
Floor joists	2.38	30	0.21		
skids	8.96	2	0.22	0.30	
TOTAL WEIGHT			2.57	0.71	kPa
Allow extra 15%			2.95	0.82	kPa

STANDARD ROOF PANEL

Span Table: Non-cyclonic region A&B (ROOF APPLICATIONS ONLY)

SPAN	SINGLE SPAN, WIND PRESSURE ACTING OUTWARDS						
	PANEL THICKNESS (mm)						
(mm)	**50**	**75**	**100**	**125**	**150**	**200**	**250**
1500	3.49	5.19	6.89	8.59	10.29	12.12	12.12
2700	1.97	2.93	3.88	4.82	5.77	6.78	6.79
3900	1.06	1.67	2.20	2.73	3.25	4.31	4.74
5100	-	1.02	1.33	1.64	1.95	2.57	3.18
6300	-	-	0.91	1.11	1.32	1.72	2.13
7500	-	-	-	-	0.96	1.25	1.54
8700	-	-	-	-	-	0.96	1.18

SPAN	MULTI SPAN, WIND PRESSURE ACTING OUTWARDS						
	PANEL THICKNESS (mm)						
(mm)	**50**	**75**	**100**	**125**	**150**	**200**	**250**
1500	2.82	4.18	4.91	4.91	4.91	4.92	4.92
2700	1.61	2.37	2.77	2.78	2.78	2.78	2.79
3900	1.14	1.67	1.95	1.96	1.96	1.96	1.97
5100	-	1.02	1.33	1.52	1.53	1.53	1.54
6300	-	-	0.91	1.11	1.26	1.26	1.27
7500	-	-	-	-	0.96	1.08	1.08
8700	-	-	-	-	-	0.95	0.95

NOTES:

1. Pressures specified are for wind gusts only per AS/NZS 1170.2
2. Deflection limit of span/150 applies, and in accordance with Serviceability Limit State criteria per AS/NZS 1170.1-Table C1
3. Self-weight of the panel has been allowed for, plus an allowance of 10kg/sq. meter for light duty fittings (lights, etc.). No other dead loads permitted.
4. Non-trafficable maintenance access (concentrated load) of 140 kg (exceeding min. requirement of AS/NZS 1170.1) on any one panel has been allowed for.
5. Distributed live load of 0.25 kPa (as per AS/NZS 1170.1) has been allowed for. Bondor tests comply with details outlined in AS 4040.0, AS 4040.1, AS 4040.2, AS 4040.3, AS 1562.1 and AS/NZS 1170.1.
6. Minimum roof slope of 3 degrees applies.

REFERENCE:

1. Technical Data Sheet, Bondor, 27/04/2020

STANDARD WALL PANEL

Span Table: Non-cyclonic region A&B (WALL APPLICATIONS ONLY)

SPAN	SINGLE SPAN, WIND PRESSURE ACTING OUTWARDS						
	PANEL THICKNESS (mm)						
(mm)	**50**	**75**	**100**	**125**	**150**	**200**	**250**
1500	4.27	6.40	8.53	10.67	12.80	17.07	21.33
2700	2.01	3.21	4.27	5.33	6.40	8.52	10.62
3900	1.03	1.54	2.05	2.56	3.07	4.08	5.10
5100	0.58	0.90	1.20	1.50	1.79	2.39	2.98
6300	0.35	0.59	0.78	0.98	1.17	1.56	1.95
7500	-	0.42	0.55	0.69	0.83	1.10	1.38
8700	-	0.31	0.41	0.51	0.62	0.82	1.02

SPAN	MULTI SPAN, WIND PRESSURE ACTING OUTWARDS						
	PANEL THICKNESS (mm)						
(mm)	**50**	**75**	**100**	**125**	**150**	**200**	**250**
1500	3.41	5.12	6.83	8.53	10.24	12.53	12.53
2700	1.90	2.84	3.79	4.74	5.69	6.96	6.96
3900	1.03	1.54	2.05	2.56	3.07	4.08	4.82
5100	0.60	0.90	1.20	1.50	1.79	2.39	2.98
6300	0.40	0.59	0.78	0.98	1.17	1.56	1.95
7500	0.28	0.42	0.55	0.69	0.83	1.10	1.38
8700	-	0.31	0.41	0.51	0.62	0.82	1.02

NOTES:

1. Fixing with min. 4x14g tek screws
2. Pressures specified are for wind gusts only per AS/NZS 1170.2
3. Deflection limit of span/150 applies, and in accordance with Serviceability Limit State criteria per AS/NZS 1170.1-Table C1. Bondor tests comply with details outlined in AS 4040.0, AS 4040.1, AS 4040.2, AS 4040.3, AS 1562.1 and AS/NZS 1170.1.

REFERENCE:

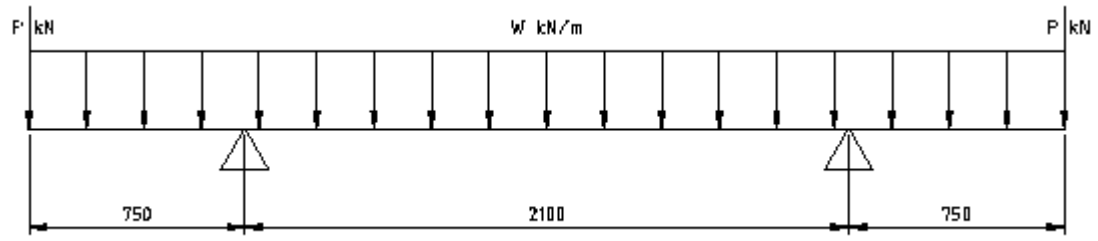
1. Technical Data Sheet, Bondor, 11/03/2020

FLOOR JOISTS 3600 WIDE UNIT

(ALSO SATISFIES 3000 WIDE UNIT)

Span = 2100 mm

Overhang = 750 mm



LOADS:

$Floor = 0.15\ kPa$

$Walls = 0.25\ kPa$

$Roof = 0.15\ kPa$

$Roof\ Live = 0.40\ kPa$

$Floor\ Live = 3.00\ kPa$

FLOOR JOIST SPACING = 600 CRS

LOADINGS:

Dead Loads	*Floor*	$0.15x0.6 = 0.09\ kN/m$
	Self-Weight	$0.03\ kN/m$
		$\sum\ 0.12\ kN/m$
	Wall	$0.25x0.6 = 0.15\ kN$
	Roof	$0.15x0.6x\frac{3.6}{2} = 0.16\ kN$
		$\sum\ 0.31\ kN$
Live Loads	*Floor*	$3.0x0.6 = 1.80\ kN/m$
	Roof	$0.40x0.6x\frac{3.6}{2} = 0.43\ kN$

TRY 50x50x1.6 SHS

Information referenced from Spacegass Analysis CS08.sg

$Max\ \partial_{dead} Mid\ span = 5\ mm$
$Max\ \partial_{live} End\ span = 12\ mm$
} *While deflections appear high, they are considered adequate for a portable structure considering the nature of the construction.*

Maximum Bending Moment:

$$M^* = 1.58\ kNm$$

$$\emptyset M_b = 1.61\ kNm$$

$$\frac{M^*}{\emptyset M_b} = 0.98 < 1.0, therefore\ OK$$

Adopt: 50x50x1.6 SHS

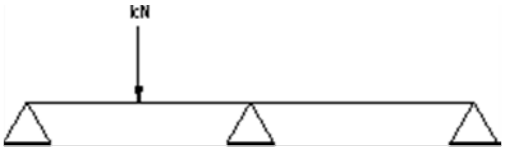
FLOORING DESIGN

MAXIMUM SPAN[1]:

THICKNESS	PRODUCT	MAXIMUM JOIST SPAN
19 mm	Yellow Tongue	450 mm
22 mm	Red Tongue	600 mm
25 mm	Blue Tongue	450 mm

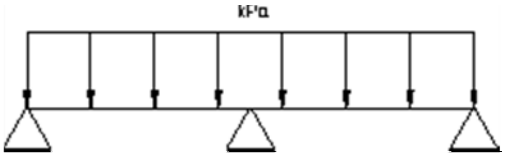
SAFE LOAD TABLES[2]:

TABLE 1: Allowable Concentrated Load Live Load – kN.
Max Deflection –Span/200 or 3mm whichever is greater



Particleboard Thickness	SPAN mm						
	300	350	400	450	500	600	700
19 mm	3.3	2.7	2.6	2.5	2.1	1.4	1.1
22 mm	4.8	4.1	3.5	3.3	3.2	2.1	1.8
25 mm	6.7	5.7	5	4.3	4.2	3.1	2.6
k_1=1.65, j_2=1			Limited By Deflection				

TABLE 2: Allowable Long Term UDL – kPa.
Max Deflection –Span/200 or 3mm whichever is greater

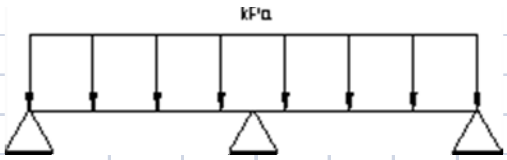


Particleboard Thickness	SPAN mm						
	300	350	400	450	500	600	700
19 mm	18.2	13.4	10.2	8.1	6.5	4.5	3.1
22 mm	24.4	17.9	13.7	11	8.8	6.1	4.5
25 mm	31.5	23.1	17.7	14	11	7.9	5.8
k_1=1, j_2=2			Limited By bending Strength				

TABLE 3: Allowable Concentrated Load Live Load – kN.
Max Deflection –Span/300 or 2mm whichever is greater

Particleboard Thickness	SPAN mm						
	300	350	400	450	500	600	700
19 mm	3.3	2.7	2.6	2.1	1.5	0.9	0.8
22 mm	4.8	4.1	3.5	3.2	2.6	1.5	1.2
25 mm	6.7	5.7	5.0	4.4	4.0	2.4	1.8
k_1=1.65, j_2=1							

TABLE 4: Allowable Long Term UDL – kPa.
Max Deflection –Span/300 or 2mm whichever is greater



Particleboard Thickness	SPAN mm						
	300	350	400	450	500	600	700
19 mm	18.2	13.4	10.2	8.1	6.5	3.5	2.0
22 mm	24.4	17.9	13.7	10.8	8.8	5.5	3.2
25 mm	31.5	23.1	17.7	14.0	11.3	7.9	4.6
k_1=1, j_2=2							

REFERENCES:

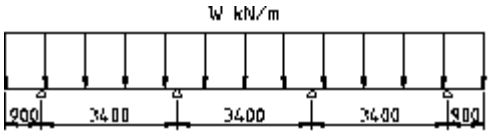
1. StructaFlor &TermiFlor Installation Manual., Woodlogic., Dec 2004
2. Particleboard Structural Flooring Design Manual., The Australian Wood Panels Association Incorporated., Sep 2001.

SKID DESIGN

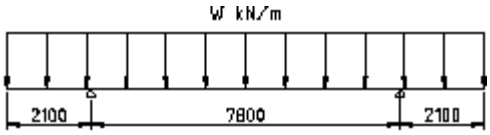
FOR 12000x3600 MODULAR UNIT CENTRAL SKID

The central skid takes no wall loads but takes end column loads supporting roof beam.

Loading



SERVICE LOADING

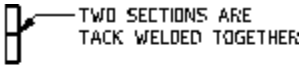


LIFTING

Service loading – Floor x 1800 width

Self-weight	DL = 0.36 kN/m
Floor Loads	LL = 5.40 kN/m
End Point Loads	DL = 1.62 kN
	LL = 2.70 kN

The floor Live and end point loads are taken as separate load cases



SECTION

2/100x50x2.5 RHS

$I = 5.4x10^6\ mm^4$

$Z = 53.1x103\ mm^3$

Using Spacegass to analyse: (refer to Spacegass output CS10_Service.sg)

Maximum Live Load deflection: - Cantilever 1.43mm

-Mid-Span 2.00mm

$M^* = 8.93\ kNm;\ \emptyset M_b = 26.37\ kNm$

$$\frac{M^*}{\emptyset M_b} = 0.34 < 1.0\ Therefore\ OK$$

LIFTING ANALYSIS:

Information referenced from Spacegass Analysis CS11_Lifiting.sg

Loading, apply Dynamic Factor = 1.25

Roof DL = 1.62 kN

Floor DL = 0.36 kN/m

Maximum Deflection:

Cantilever = 28.59mm (Considered to be OK as a short term lifting deflection)

Mid-span = 13.17mm = $\frac{span}{592}$

$M^* = 5.24\ kNm;\ \emptyset M_b = 26.37\ kNm$

$$\frac{M^*}{\emptyset M_b} = 0.20 < 1.0, \qquad therefore\ OK$$

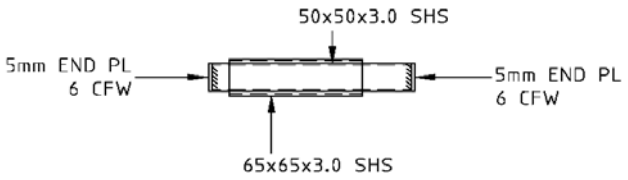
PAD FOOTING: $DL + LL = 19.35\ kN$

Adopt 450x450x60 Concrete Footing;

Bearing Pressure = $\frac{19.35}{450^2} = 95.55\ kPa$

Adopt 2/100x50x2.5 RHS and 450x450x60 Pad Footing

STANDARD LIFTER – 12000x3000 UNIT



LIFTER DETAIL

LOADS:
$Floor = 0.40\ kPa$
$Walls = 0.25\ kN/m$
$Roof\ = 0.164\ kN/m^2$
$Apply: Ultimate\ Dead\ load\ factor\ = 1.2$
$Dynamic\ factor\ = 1.25$

Refer Spacegass output:
$P^*\ = 11.16\ kN$
$M^*\ = 11.16 * 0.1\ = 1.116\ kNm$

$Try\ 50x50x3.0\ SHS\ C350$
$\emptyset M_{bx} = 2.96\ kNm\ >\ M^*\ therefore\ OK$

Check welding:
$Total\ welding\ length\ = 400mm$
$Design\ Capacity\ of\ 6\ CFW$:

$= 0.36 f_{uw} t_t k_r$ $\quad Where\ f_{uw} = 410\ mPa$, $t_t = 4.24\ mm$, $k_r = 1.0$

$= 0.36x410x4.24x1.0$
$= 0.625\ kN$

$For\ 400mm\ of\ 6\ CFW$
$= 0.625 * 400\ =\ 250\ kN\ > P^*\ therefore\ OK$

Use	**50x50x3.0 SHS C350 for Lifter**
	60x60x3.0 SHS C350 for Outer Sleeve
	6 CFW to Lifting Beam/Floor Joist