

STRUCTURAL CALCULATIONS

Job Number: 19/177-3

Client: TRUE STEEL FRAMES

For: COSCIA

Site Address: No. 4 REDWOOD STREET, ROSTREVOR (DW3)

Design: A.N.

Date: OCT'19

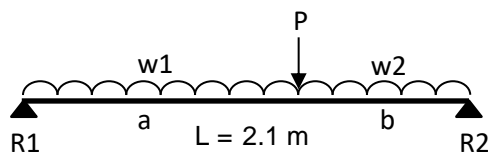
Revision: -

Australian Standards applicable to attached calculations

- Dead and live loads and load combinations to **AS 1170.0/1**
- Wind Loads to **AS 1170.2 & AS 4055**
- Steelwork to **AS 4100 & AS 4600**

BEAM B1

a = 1.2 m
b = 0.9 m



Design Loads

UDL - w1			DL (kN/m)		LL (kN/m)
Beam S/Weight			0.05		
Wall (L.Weight)	2.70 m	0.60 kPa	1.62		
Roof (Sheet)	3.80 m	0.40 kPa	1.52	0.25 kPa	0.95
Domestic Floor	0.00 m	1.00 kPa	0.00	1.50 kPa	0.00

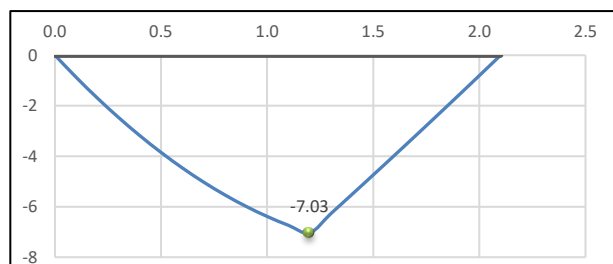
UDL - w2			DL (kN/m)		LL (kN/m)
Wall (L.Weight)	0.70 m	0.60 kPa	0.42		
Roof (Sheet)	0.00 m	0.40 kPa	0.00	0.25 kPa	0.00
Domestic Floor	0.00 m	1.00 kPa	0.00	1.50 kPa	0.00

Design Load Combinations

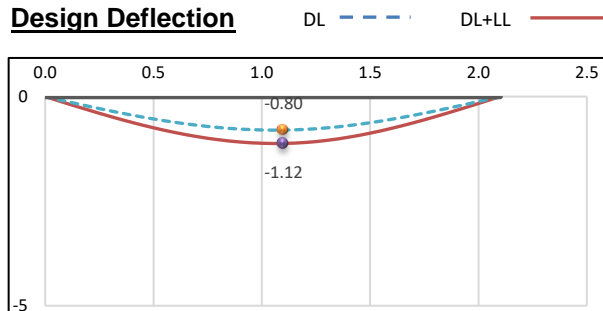
	w1	w2	P	R1	R2
[S] DL	3.19	0.47	5.41	5.1	4.5
[S] LL	0.95	0.00	2.52	1.9	1.8
[U] 1.2DL+1.5LL	5.25	0.56	10.27	9.0	8.1

TRY: TSF4510 Le = 1.2 m

Design Bending Moment



Design Deflection



Checks

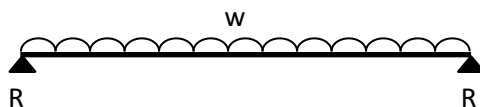
M* =	7.03 kNm	M _{oa} =	26.74
φM _{sx} =	20.02 kNm :: OK	α _s =	0.65
φM _{bx} =	13.09 kNm :: OK	α _m =	1.00

I _x =	9.70 x 10 ⁶ mm ⁴
Δ _{DL} =	0.80 mm (L / 2625)
Δ _{DL+LL} =	1.12 mm (L / 1875)

Adopt: TSF4510 Or 2/C20019 (boxed)

BEAM B2

L = 3.2 m



Design Loads

			<u>DL (kN/m)</u>		<u>LL (kN/m)</u>
Beam S/Weight			0.08		
Wall (L.Weight)	2.70 m	0.60 kPa	1.62		
Roof (Sheet)	2.70 m	0.40 kPa	1.08	0.25 kPa	0.68
Domestic Floor	0.60 m	1.00 kPa	0.60	1.50 kPa	0.90

Design Load Combinations

	<u>w</u>	<u>R</u>
[S] DL	3.38	5.41
[S] LL	1.58	2.52
[U] 1.2DL+1.5LL	6.42	10.27

TRY: 2 / TSF4575

Le = 0.60 m

Check Bending

$M^*_{mid} =$	8.22 kNm	$M_{oa} =$	258.14
$\phi M_{sx} =$	28.27 kNm :: OK	$\alpha_s =$	0.97
$\phi M_{bx} =$	27.39 kNm :: OK	$\alpha_m =$	1.00

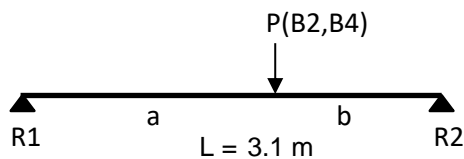
Check Deflection

$I_x =$	14.00 x 10 ⁶ mm ⁴
$\Delta_{DL} =$	1.65 mm (L / 1942)
$\Delta_{DL+LL} =$	2.42 mm (L / 1325)

Adopt: 2 / TSF4575

BEAM B3

a = 1.2 m (a>b)
b = 1.9 m
c = a+2b = 5.0 m



Design Loads

	<u>P</u>	<u>R1</u>	<u>R2</u>
[S] DL	10.71	6.72	4.30
[S] LL	5.12	3.14	1.98
[U] 1.2DL+1.5LL	20.47	12.73	8.11
Beam S/Weight	0.10		

TRY: 2 / TSF3510 Le = 1.9 m

Check Bending

M* =	15.19 kNm	M _{oa} =	75.94
φM _{sx} =	27.48 kNm :: OK	α _s =	0.83
φM _{bx} =	22.69 kNm :: OK	α _m =	1.00

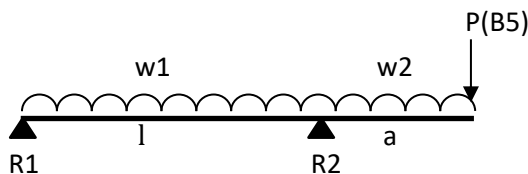
Check Deflection

I _x =	10.30 x 10 ⁶ mm ⁴	
Δ _{DL} =	3.07 mm	(L / 1010)
Δ _{DL+LL} =	4.51 mm	(L / 688)

Adopt: 2 / TSF3510 Or 2/C20024 (boxed)

BEAM B4

l = 3.6 m
a = 0.5 m
L = 4.1 m



Design Loads

UDL - w1			DL (kN/m)		LL (kN/m)
Beam S/Weight			0.08		
Wall (L.Weight)	2.70 m	0.60 kPa	1.62		
Roof (Sheet)	2.70 m	0.40 kPa	1.08	0.25 kPa	0.68
Domestic Floor	0.60 m	1.00 kPa	0.60	1.50 kPa	0.90

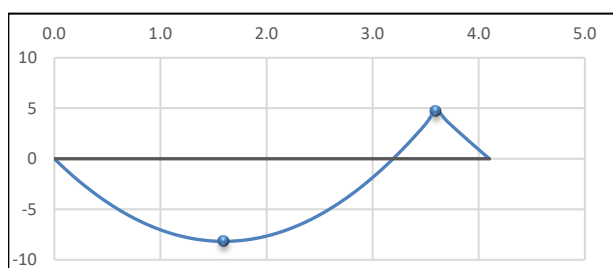
UDL - w2			DL (kN/m)		LL (kN/m)
Wall (L.Weight)	2.70 m	0.60 kPa	1.62		
Roof (Sheet)	0.00 m	0.40 kPa	0.00	0.25 kPa	0.00
Domestic Floor	0.00 m	1.00 kPa	0.00	1.50 kPa	0.00

Design Load Combinations

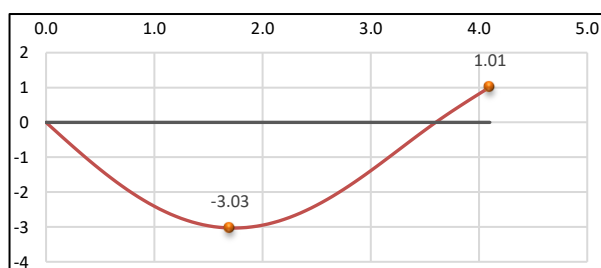
	w1		w2		P	R1	R2
[S]	DL+LL	4.96	DL	1.70	5.40	8.1	16.0
[U]	1.2DL+1.5LL	6.42	1.2DL	2.04	8.90	10.2	22.8

TRY: 2 / TSF4575 Le = 0.6 m

Design Bending Moment



Design Deflection



Design Bending Moments & Deflection

M* = 8.18 kNm
-M* = -4.71 kNm
 ϕM_{sx} = 28.27 kNm :: OK
 ϕM_{bx} = 27.39 kNm :: OK

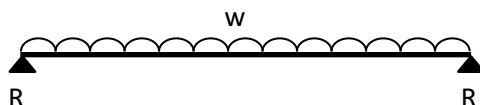
M_{oa} = 258.14
 α_s = 0.97
 α_m = 1.00

I_x = 14.00 x 10⁶ mm⁴
 Δ_l = 3.03 mm (l / 1188)
 Δ_a = 1.01 mm (a / 495)

Adopt: 2 / TSF4575

BEAM B5

L = 3.4 m



Design Loads

			<u>DL (kN/m)</u>		<u>LL (kN/m)</u>
Beam S/Weight			0.05		
Wall (L.Weight)	2.70 m	0.60 kPa	1.62		
Roof (Sheet)	3.80 m	0.40 kPa	1.52	0.25 kPa	0.95
Domestic Floor	0.00 m	1.00 kPa	0.00	1.50 kPa	0.00

Design Load Combinations

	<u>w</u>	<u>R</u>
[S] DL	3.19	5.42
[S] LL	0.95	1.62
[U] 1.2DL+1.5LL	5.25	8.93

TRY: TSF4510 Le = 1.50 m

Check Bending

M* _{mid} =	7.59 kNm	M _{oa} =	21.02
φM _{sx} =	20.02 kNm :: OK	α _s =	0.58
φM _{bx} =	11.67 kNm :: OK	α _m =	1.00

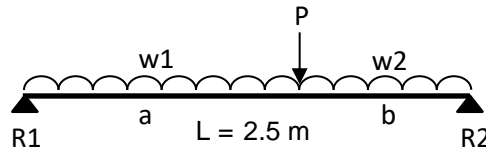
Check Deflection

I _x =	9.70 x 10 ⁶ mm ⁴	
Δ _{DL} =	2.86 mm	(L / 1188)
Δ _{DL+LL} =	3.71 mm	(L / 916)

Adopt: TSF4510

LINTEL L1

a = 1.6 m
b = 0.9 m



Design Loads

UDL - w1			DL (kN/m)		LL (kN/m)
Beam S/Weight			0.20		
Wall (D.Brick)	0.70 m	4.40 kPa	3.08		
Roof (Sheet)	1.00 m	0.40 kPa	0.40	0.25 kPa	0.25
Domestic Floor	0.00 m	1.00 kPa	0.00	1.50 kPa	0.00

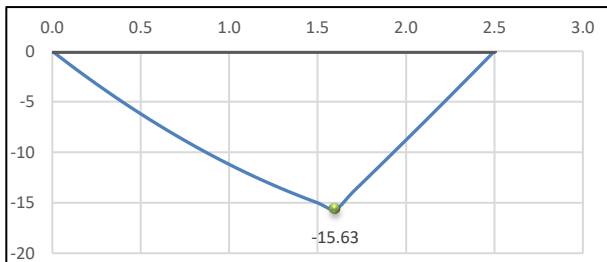
UDL - w2			DL (kN/m)		LL (kN/m)
Wall (Brick Vnr)	0.30 m	2.40 kPa	0.72		
Roof (Sheet)	0.00 m	0.40 kPa	0.00	0.25 kPa	0.00
Domestic Floor	0.00 m	1.00 kPa	0.00	1.50 kPa	0.00

Design Load Combinations

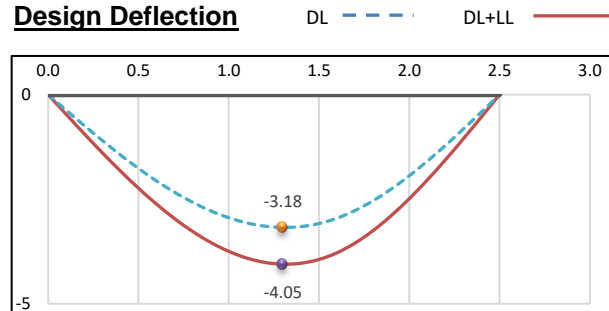
	w1	w2	P	R1	R2
[S] DL	3.68	0.92	13.10	8.9	10.9
[S] LL	0.25	0.00	4.70	2.0	3.1
[U] 1.2DL+1.5LL	4.79	1.10	22.80	13.6	17.9

TRY: 150PFC Le = 2.5 m

Design Bending Moment



Design Deflection



Checks

M* =	15.63 kNm	M _{oa} =	48.77
φM _{sx} =	37.00 kNm :: OK	α _s =	0.65
φM _{bx} =	24.05 kNm :: OK	α _m =	1.00

I _x =	8.34 x 10 ⁶ mm ⁴
Δ _{DL} =	3.18 mm (L / 786)
Δ _{DL+LL} =	4.05 mm (L / 617)

Adopt: 150PFC

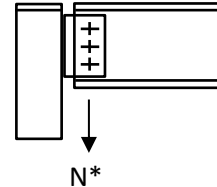
Or T-Lintel 200 x 10 plate + 200 x 10 riser
(I_x = 17.7 x 10⁶ mm⁴, M_{bx} = 25kNm)

COLUMN C1

Height = 3.0 m

Loads

$N^* = 9.00$ kN
 $N_e^* = 9.00$ kN
 $M_e^* = 1.30$ kNm (e = 0.145 m)



TRY: 89x89x2.0 SHS

Properties

$\phi N_s = 172.0$ kN (for $l_e = 3.0$ m)
 $\phi N_{cy} = 117.0$ kN
 $\phi M_{sx} = 5.31$ kNm
 $\phi M_{bx} = 5.3$ kNm

Check section capacity

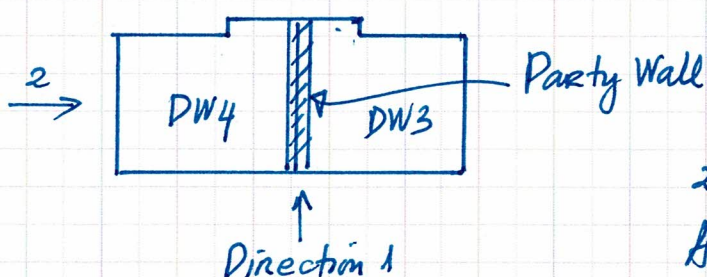
$$\frac{M_e^*}{\phi M_s} + \frac{N^*}{\phi N_s} = 0.30 < 1.0, \text{ therefore OK}$$

Check member capacity

$$\frac{M_e^*}{\phi M_b} + \frac{N^*}{\phi N_c} = 0.32 < 1.0, \text{ therefore OK}$$

Adopt: 89x89x2.0 SHS

Ground Floor Bracing



1) Bracing for wind load in dir. 1

Refer to TSF details.

2) Bracing for wind load in dir. 2

Assume two dwellings to act as one structure for stability under wind load in direction 2. (similar DW1+2)

Wind speed $N1$
Roof pitch $22^\circ \Rightarrow P_{net} = 0.52 \text{ kPa ult. (AS4055, Table 5.2-13)}$

Elevation area = 44 m^2

\Rightarrow Racking force $F_R = 0.52 \times 44 = 23 \text{ kN}$

1) Cross brace using $30 \times 1.0 / 4250$ strap

0.9 m	$- 1.5 \text{ kN}$
1.2 m	$- 1.9 \text{ kN}$
1.8 m	$- 2.7 \text{ kN}$

$0.9 \text{ m} - 1 \text{ length} = 1.5 \text{ kN}$, 2 dwellings $\rightarrow 3.0 \text{ kN}$

ii) 5mm Hardie-Brace : 5.4 kN/m

$0.9 + 0.9 + 1.2 \text{ m} = 3.0 \text{ m}$

\Rightarrow capacity = 16.2 kN , 2 dwellings $\rightarrow 32.4 \text{ kN}$

\therefore Total capacity = $35.4 \text{ kN} > \text{Required.}$