

STRUCTURAL CALCULATIONS

Job Number: 19/177-4

Client: TRUE STEEL FRAMES

For: COSCIA

Site Address: No. 4 REDWOOD STREET, ROSTREVOR (DW4)

Design: A.N.

Date: OCT'19

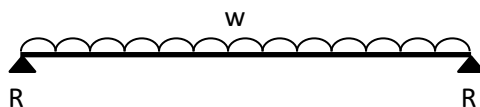
Revision: -

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

L = 5.2 m



Design Loads

			<u>DL (kN/m)</u>		<u>LL (kN/m)</u>
Beam S/Weight			0.06		
Wall (L.Weight)	0.00 m	0.60 kPa	0.00		
Roof (Sheet)	0.00 m	0.40 kPa	0.00	0.25 kPa	0.00
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	0.66	1.72
[S] LL	0.90	2.34
[U] 1.2DL+1.5LL	2.14	5.57

TRY: TSF4575 (boxed top) Le = 0.60 m

Check Bending

M* _{mid} =	7.24 kNm	M _{oa} =	58.50
φM _{sx} =	18.16 kNm :: OK	α _s =	0.85
φM _{bx} =	15.48 kNm :: OK	α _m =	1.00

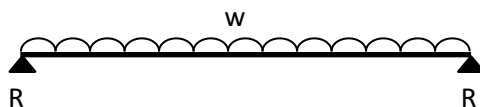
Check Deflection

I _x =	9.76 x 10 ⁶ mm ⁴	
Δ _{DL} =	3.22 mm	(L / 1615)
Δ _{DL+LL} =	7.61 mm	(L / 683)

Adopt: TSF4575 (boxed top)

BEAM B2

L = 3.5 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)	2.15 m	0.40 kPa	0.86	0.25 kPa	0.54
Domestic Floor	1.05 m	1.00 kPa	1.05	1.50 kPa	1.58

Design Load Combinations

	<u>w</u>	<u>R</u>
[S] DL	3.61	6.32
[S] LL	2.11	3.70
[U] 1.2DL+1.5LL	7.50	13.13

TRY: 2 / TSF4575

Le = 0.60 m

Check Bending

M* _{mid} =	11.49 kNm	M _{oa} =	258.14
φM _{sx} =	28.27 kNm :: OK	α _s =	0.97
φM _{bx} =	27.39 kNm :: OK	α _m =	1.00

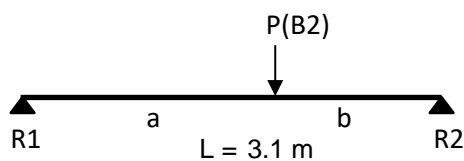
Check Deflection

I _x =	14.00 x 10 ⁶ mm ⁴
Δ _{DL} =	2.52 mm (L / 1390)
Δ _{DL+LL} =	3.99 mm (L / 877)

Adopt: 2 / TSF4575

BEAM B3

a = 1.0 m (a>b)
b = 2.1 m
c = a+2b = 5.2 m



Design Loads

	<u>P</u>	<u>R1</u>	<u>R2</u>
[S] DL	10.32	7.14	3.48
[S] LL	6.00	4.06	1.93
[U] 1.2DL+1.5LL	21.33	14.63	7.07
Beam S/Weight	0.10		

TRY: 2 / TSF3510 Le = 2.1 m

Check Bending

M* =	14.57 kNm	M _{oa} =	68.10
φM _{sx} =	27.48 kNm :: OK	α _s =	0.80
φM _{bx} =	22.11 kNm :: OK	α _m =	1.00

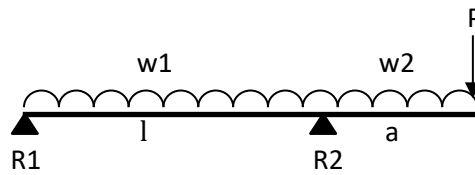
Check Deflection

I _x =	10.30 x 10 ⁶ mm ⁴	
Δ _{DL} =	2.68 mm	(L / 1158)
Δ _{DL+LL} =	4.20 mm	(L / 738)

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

BEAM B4

$l =$ 2.2 m
 $a =$ 1.2 m
 $L =$ 3.4 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

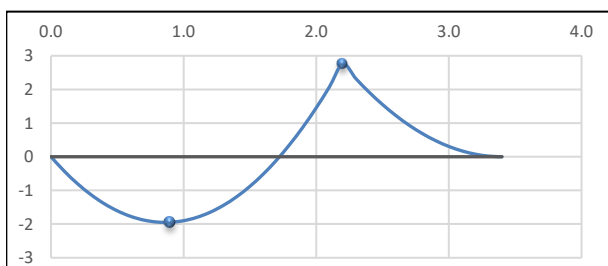
UDL - w2			DL (kN/m)		LL (kN/m)
Wall (L.Weight)	2.70 m	0.60 kPa	1.62		
Roof (Sheet)	3.80 m	0.40 kPa	1.52	0.25 kPa	0.95
Domestic Floor	0.00 m	1.00 kPa	0.00	1.50 kPa	0.00

Design Load Combinations

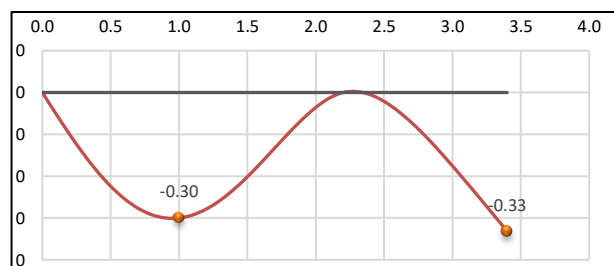
	w1		w2		P	R1	R2
[S]	DL+LL	4.14	DL	3.19	0.00	3.5	9.4
[U]	1.2DL+1.5LL	5.25	1.2DL	3.83	0.00	4.5	11.6

TRY: TSF4510 $Le =$ 2.2 m

Design Bending Moment



Design Deflection



Design Bending Moments & Deflection

$M^* =$ 1.95 kNm
 $-M^* =$ -2.76 kNm
 $\phi M_{sx} =$ 20.02 kNm :: OK
 $\phi M_{bx} =$ 9.18 kNm :: OK

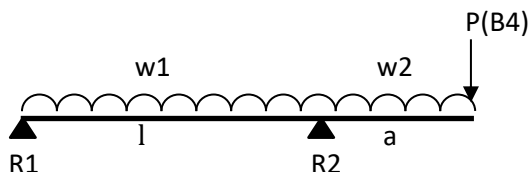
$M_{oa} =$ 14.08
 $\alpha_s =$ 0.46
 $\alpha_m =$ 1.00

$I_x =$ $9.70 \times 10^6 \text{ mm}^4$
 $\Delta_l =$ 0.30 mm (l / 7333)
 $\Delta_a =$ 0.33 mm (a / 3636)

Adopt: TSF4510

BEAM B5

$l =$ 1.2 m
 $a =$ 0.6 m
 $L =$ 1.8 m



Design Loads

UDL - w1

			DL (kN/m)		LL (kN/m)
Beam S/Weight			0.04		
Wall (L.Weight)	0.00 m	0.60 kPa	0.00		
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

UDL - w2

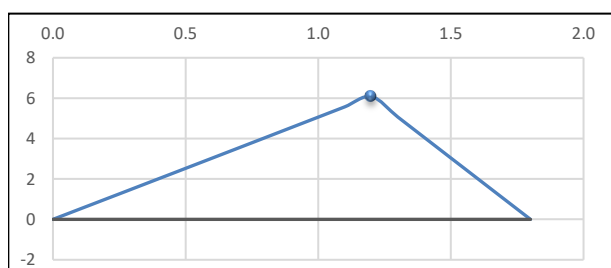
			DL (kN/m)		LL (kN/m)
Wall (L.Weight)	0.00 m	0.60 kPa	0.00		
Roof (Sheet)	0.00 m	0.40 kPa	0.00	0.25 kPa	0.00
Domestic Floor	0.00 m	1.00 kPa	0.00	1.50 kPa	0.00

Design Load Combinations

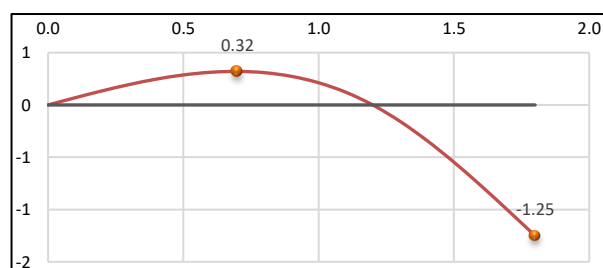
	w1		w2		P	R1	R2
[S]	DL	0.04	DL+LL	0.04	8.11	-4.0	12.2
[U]	1.2DL	0.05	1.2DL+1.5LL	0.05	10.12	-5.0	15.2

TRY: TSF4575 $Le =$ 0.6 m

Design Bending Moment



Design Deflection



Design Bending Moments & Deflection

$M^* =$ 0.00 kNm
 $-M^* =$ -6.08 kNm
 $\phi M_{sx} =$ 14.14 kNm :: OK
 $\phi M_{bx} =$ 11.54 kNm :: OK

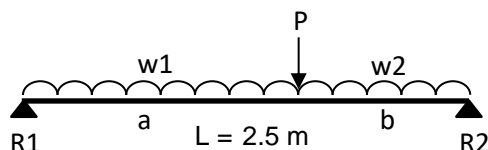
$M_{oa} =$ 37.15
 $\alpha_s =$ 0.82
 $\alpha_m =$ 1.00

$I_x =$ $7.00 \times 10^6 \text{ mm}^4$
 $\Delta_l =$ 0.32 mm (l / 3750)
 $\Delta_a =$ 1.25 mm (a / 480)

Adopt: TSF4575

LINTEL L1

a = 1.9 m
b = 0.6 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)	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

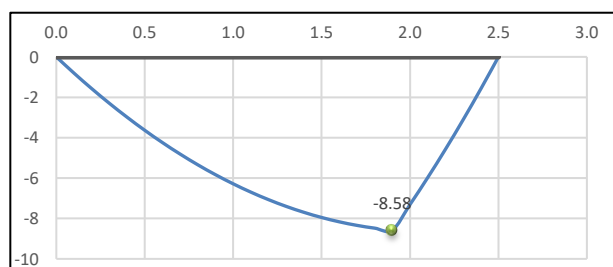
UDL - w2			DL (kN/m)		LL (kN/m)
Wall (Brick Vnr)	0.30 m	2.40 kPa	0.72		
Wall (L.Weight)	2.70 m	0.60 kPa	1.62		
Roof (Sheet)	4.00 m	0.40 kPa	1.60	0.25 kPa	1.00
Domestic Floor	0.00 m	1.00 kPa	0.00	1.50 kPa	0.00

Design Load Combinations

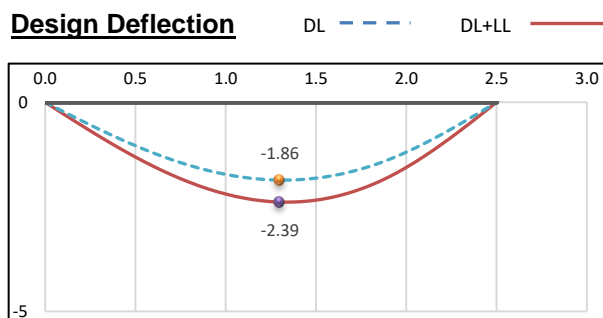
	w1	w2	P	R1	R2
[S] DL	3.28	4.14	6.32	5.7	9.4
[S] LL	0.00	1.00	3.70	1.0	3.3
[U] 1.2DL+1.5LL	3.94	6.47	13.13	8.3	16.2

TRY: 150PFC Le = 2.5 m

Design Bending Moment



Design Deflection



Checks

M* =	8.58 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} =	1.86 mm (L / 1344)
Δ _{DL+LL} =	2.39 mm (L / 1046)

Adopt: 150PFC

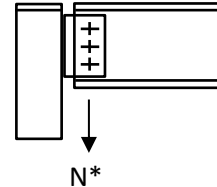
Or T-Lintel 200 x 10 plate + 200 x 10 riser
(I_x = 17.7 x 10⁶ mm⁴, M_{bx} = 25kNm)

COLUMN C1

Height = 3.0 m

Loads

$N^* = 4.50$ kN
 $N_e^* = 4.50$ kN
 $M_e^* = 0.65$ 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

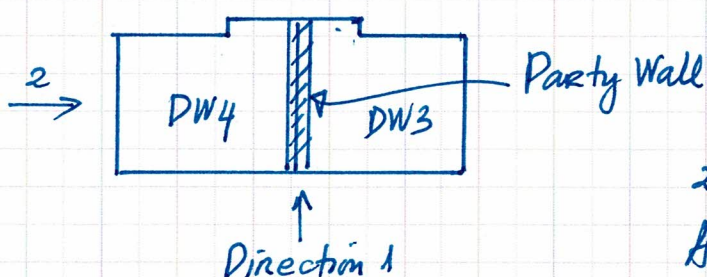
$$\frac{M_e^*}{\phi M_s} + \frac{N^*}{\phi N_s} = 0.15 < 1.0, \text{ therefore OK}$$

Check member capacity

$$\frac{M_e^*}{\phi M_b} + \frac{N^*}{\phi N_c} = 0.16 < 1.0, \text{ therefore OK}$$

Adopt: 89x89x2.0 SHS

Ground Floor Bracing



17 Bracing for wind load in dir. 1

Refer to TSF details.

27 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 $22^\circ \Rightarrow P_{net} = 0.52 \text{ kPa ult. (AS4055, Table S.2-.13)}$

Elevation area = 44 m^2

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

17 Cross brace using $30 \times 1.0 / 4250$ strap

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

$0.9 \text{ m} - 1 \text{ length} = 1.5 \text{ kN}$, 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 = $35.4 \text{ kN} > \text{Required.}$