

STRUCTURAL CALCULATIONS

Job Number: 19/177-2

Client: TRUE STEEL FRAMES

For: COSCIA

Site Address: No. 4 REDWOOD STREET, ROSTREVOR (DW2)

Design: A.N.

Date: OCT'19

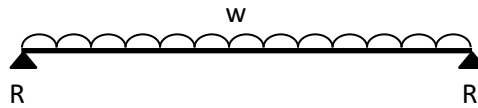
Revision: -

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 = 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)	4.25 m	0.40 kPa	1.70	0.25 kPa	1.06
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	3.37	5.73
[S] LL	1.06	1.81
[U] 1.2DL+1.5LL	5.64	9.58

TRY: TSF4510 Le = 1.50 m

Check Bending

M* _{mid} =	8.15 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

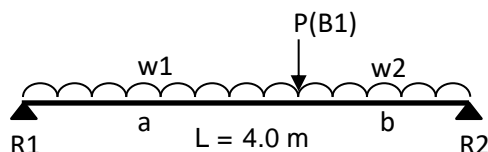
Check Deflection

I _x =	9.70 x 10 ⁶ mm ⁴	
Δ _{DL} =	3.02 mm	(L / 1125)
Δ _{DL+LL} =	3.98 mm	(L / 855)

Adopt: TSF4510

BEAM B2

a = 2.3 m
b = 1.7 m



Design Loads

UDL - w1			DL (kN/m)		LL (kN/m)
Beam S/Weight			0.10		
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	1.70 m	1.00 kPa	1.70	1.50 kPa	2.55

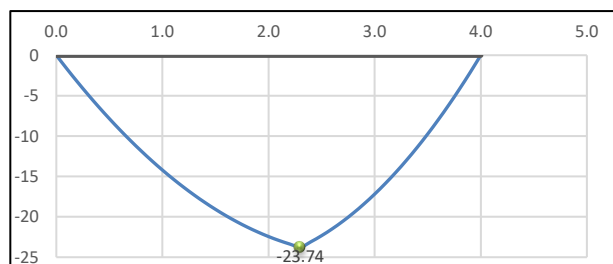
UDL - w2			DL (kN/m)		LL (kN/m)
Wall (L.Weight)	2.70 m	0.60 kPa	1.62		
Roof (Sheet)	0.00 m	0.40 kPa	0.00	0.25 kPa	0.00
Balcony Floor	1.70 m	1.00 kPa	1.70	2.00 kPa	3.40

Design Load Combinations

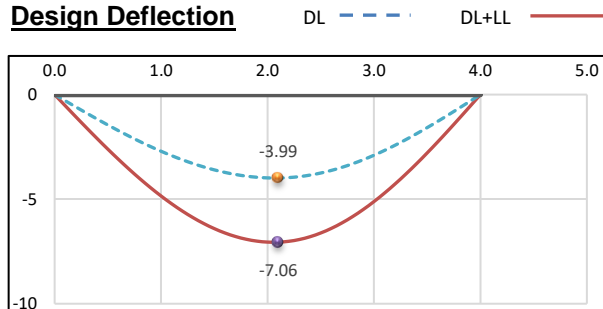
	w1	w2	P	R1	R2
[S] DL	1.80	3.42	5.73	6.6	9.1
[S] LL	2.55	3.40	1.81	6.2	7.3
[U] 1.2DL+1.5LL	5.99	9.20	9.58	17.2	21.8

TRY: 2 / TSF4510 Le = 0.6 m

Design Bending Moment



Design Deflection



Checks

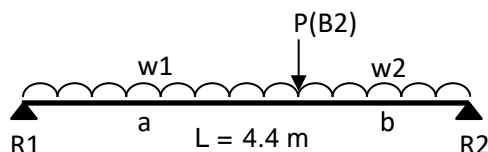
M* =	23.74 kNm	M _{oa} =	381.92
φM _{sx} =	40.04 kNm :: OK	α _s =	0.97
φM _{bx} =	38.91 kNm :: OK	α _m =	1.00

I _x =	19.40 x 10 ⁶ mm ⁴
Δ _{DL} =	3.99 mm (L / 1003)
Δ _{DL+LL} =	7.06 mm (L / 567)

Adopt: 2 / TSF4510 Or 2/C25024 (boxed)

BEAM B3

a = 1.0 m
b = 3.4 m



Design Loads

UDL - w1			DL (kN/m)		LL (kN/m)
Beam S/Weight			0.08		
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

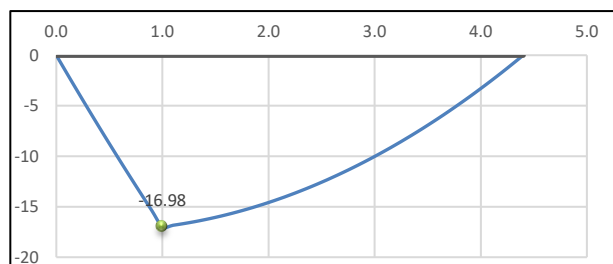
UDL - w2			DL (kN/m)		LL (kN/m)
Wall (L.Weight)	0.00 m	0.60 kPa	0.00		
Roof (Sheet)	0.00 m	0.40 kPa	0.00	0.25 kPa	0.00
Domestic Floor	0.60 m	1.00 kPa	0.60	1.50 kPa	0.90

Design Load Combinations

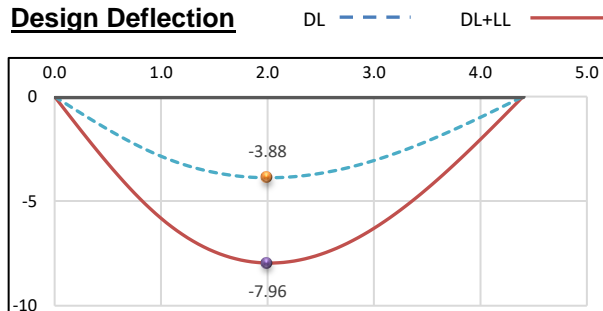
	w1	w2	P	R1	R2
[S] DL	0.68	0.68	6.62	6.6	3.0
[S] LL	0.90	0.90	6.17	6.8	3.4
[U] 1.2DL+1.5LL	2.17	2.17	17.21	18.1	8.7

TRY: 2 / TSF4575 Le = 1.5 m

Design Bending Moment



Design Deflection



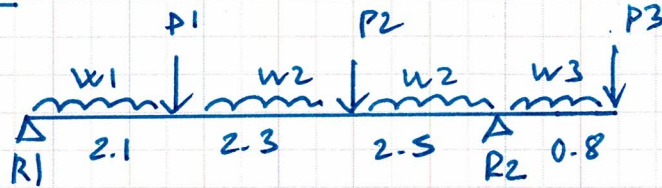
Checks

M* =	16.98 kNm	M _{oa} =	61.51
φM _{sx} =	28.27 kNm :: OK	α _s =	0.78
φM _{bx} =	21.97 kNm :: OK	α _m =	1.00

I _x =	14.00 x 10 ⁶ mm ⁴
Δ _{DL} =	3.88 mm (L / 1134)
Δ _{DL+LL} =	7.96 mm (L / 553)

Adopt: 2 / TSF4575 Or 2/C25019 (boxed)

Beam B4



$$\begin{aligned} W_{1DL} &= 1.0 \times 0.6 \text{ kPa} + 1.7 \times 1.0 \text{ kPa} + 0.4 = 2.7 \text{ kN/m} \\ W_{1LL} &= 1.7 \times 2.0 \text{ kPa} = 3.4 \text{ kN/m} \\ \Rightarrow W_1 &= 6.1 \text{ kN/m} ; W_1^* = 8.3 \text{ kN/m} \end{aligned}$$

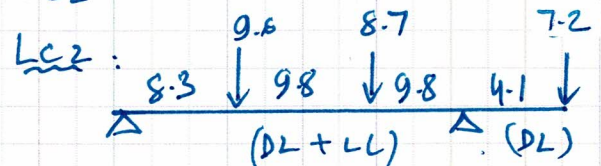
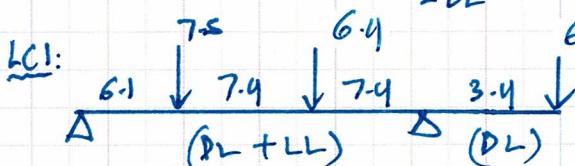
$$\begin{aligned} W_{2DL} &= 2.7 \times 0.6 \text{ kPa} + 1.6 \times 0.4 \text{ kPa} + 1.7 \times 1.0 \text{ kPa} + 0.4 = 4.4 \text{ kN/m} \\ W_{2LL} &= 1.6 \times 0.25 \text{ kPa} + 1.7 \times 1.5 \text{ kPa} = 3.0 \text{ kN/m} \\ \Rightarrow W_2 &= 7.4 \text{ kN/m} ; W_2^* = 9.8 \text{ kN/m} \end{aligned}$$

$$\begin{aligned} W_{3DL} &= 2.7 \times 0.6 + 1.4 \times 1.0 \text{ kPa} + 0.4 = 3.4 \text{ kN/m} \\ \Rightarrow W_{3DL}^* &= 4.1 \text{ kN/m} \end{aligned}$$

$$P1 : B1 \rightarrow R = 7.5 \text{ kN} ; R^* = 9.6 \text{ kN}$$

$$P2 : B3 \rightarrow R_2 = 6.4 \text{ kN} ; R_2^* = 8.7 \text{ kN}$$

$$P3 : B5 \rightarrow R_{2DL} = 6.0 \text{ kN} ; R_{2DL}^* = 7.2 \text{ kN}$$



Deflection 11 mm (b/span) ; 4 mm (cantilever end)
using 360 UB45

M^* @ mid span = 74 (back span)

$$L_e = 0.6 \text{ m} \rightarrow \phi M_b = M_s = 222 \text{ kNm}$$

\therefore Adopt 360 UB45

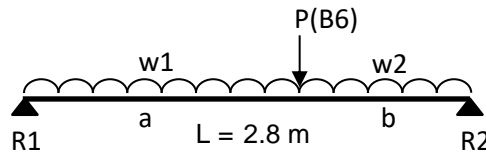
$$\begin{aligned} R1 &= 30 \text{ kN} \\ R1^* &= 40 \text{ kN} \end{aligned} \quad \begin{aligned} R2 &= 41 \text{ kN} \\ R2^* &= 52.5 \text{ kN} \end{aligned}$$

Calculate R_{1DL} :

$$\begin{aligned} P_{1DL} &= 5.7 ; P_{2DL} = 3.0 \text{ kN} \\ \Rightarrow R_{1DL} &= 16 \text{ kN} ; R_{1DL}^* = 19.2 \text{ kN} \end{aligned}$$

BEAM B5

a = 1.4 m
b = 1.4 m



Design Loads

UDL - w1			DL (kN/m)		LL (kN/m)
Beam S/Weight			0.08		
Wall (L.Weight)	0.00 m	0.60 kPa	0.00		
Roof (Sheet)	3.60 m	0.40 kPa	1.44	0.25 kPa	0.90
Domestic Floor	0.00 m	1.00 kPa	0.00	1.50 kPa	0.00

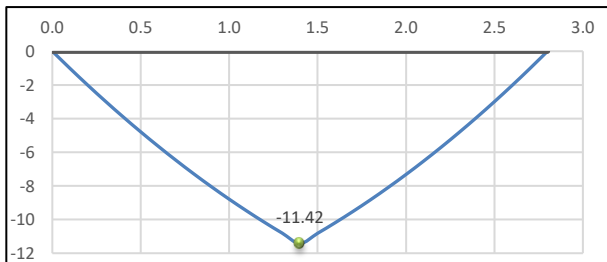
UDL - w2			DL (kN/m)		LL (kN/m)
Wall (L.Weight)	2.70 m	0.60 kPa	1.62		
Roof (Sheet)	1.50 m	0.40 kPa	0.60	0.25 kPa	0.38
Domestic Floor	0.00 m	1.00 kPa	0.00	1.50 kPa	0.00

Design Load Combinations

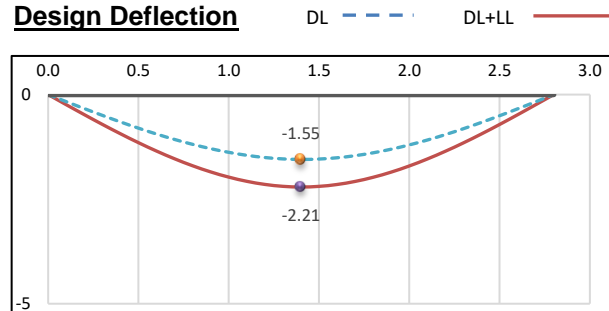
	w1	w2	P	R1	R2
[S] DL	1.52	2.30	6.15	5.5	6.0
[S] LL	0.90	0.38	2.92	2.5	2.2
[U] 1.2DL+1.5LL	3.17	3.32	11.76	10.4	10.5

TRY: 2 / TSF4575 Le = 1.4 m

Design Bending Moment



Design Deflection



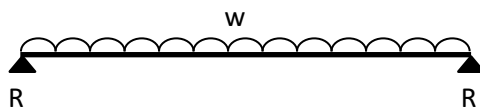
Checks

M* =	11.42 kNm	M _{oa} =	67.57
φM _{sx} =	28.27 kNm :: OK	α _s =	0.80
φM _{bx} =	22.53 kNm :: OK	α _m =	1.00
I _x =	14.00 x 10 ⁶ mm ⁴		
Δ _{DL} =	1.55 mm (L / 1806)		
Δ _{DL+LL} =	2.21 mm (L / 1267)		

Adopt: 2 / TSF4575 Or 2/C25024 (boxed)

BEAM B6

L = 4.1 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)	1.50 m	0.40 kPa	0.60	0.25 kPa	0.38
Domestic Floor	0.70 m	1.00 kPa	0.70	1.50 kPa	1.05

Design Load Combinations

	<u>w</u>	<u>R</u>
[S] DL	3.00	6.15
[S] LL	1.43	2.92
[U] 1.2DL+1.5LL	5.74	11.76

TRY: 2 / TSF4575

Le = 0.60 m

Check Bending

M* _{mid} =	12.06 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

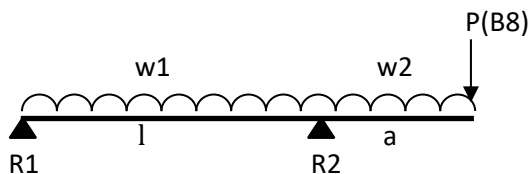
Check Deflection

I _x =	14.00 x 10 ⁶ mm ⁴
Δ _{DL} =	3.94 mm (L / 1040)
Δ _{DL+LL} =	5.81 mm (L / 705)

Adopt: 2 / TSF4575

BEAM B7

l = 5.7 m
a = 0.8 m
L = 6.5 m



Design Loads

UDL - w1

			DL (kN/m)		LL (kN/m)
Beam S/Weight			0.40		
Wall (L.Weight)	2.70 m	0.60 kPa	1.62		
Roof (Sheet)	2.10 m	0.40 kPa	0.84	0.25 kPa	0.53
Domestic Floor	2.15 m	1.00 kPa	2.15	1.50 kPa	3.23

UDL - w2

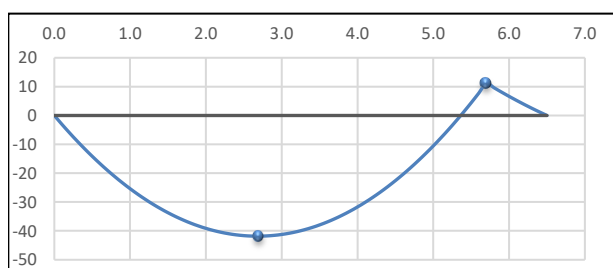
			DL (kN/m)		LL (kN/m)
Wall (L.Weight)	2.70 m	0.60 kPa	1.62		
Roof (Sheet)	0.00 m	0.40 kPa	0.00	0.25 kPa	0.00
Domestic Floor	2.15 m	1.00 kPa	2.15	1.50 kPa	3.23

Design Load Combinations

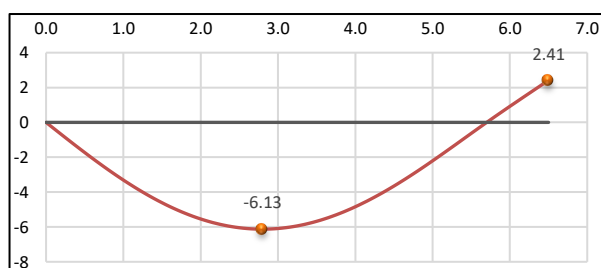
	w1		w2		P	R1	R2
[S]	DL+LL	8.76	DL	4.17	7.30	23.7	36.9
[U]	1.2DL+1.5LL	11.64	1.2DL	5.00	12.00	31.2	51.1

TRY: 310UB40 Le = 0.6 m

Design Bending Moment



Design Deflection



Design Bending Moments & Deflection

M* = 41.82 kNm
-M* = -11.20 kNm
 ϕM_{sx} = 182.00 kNm :: OK
 ϕM_{bx} = 182.00 kNm :: OK

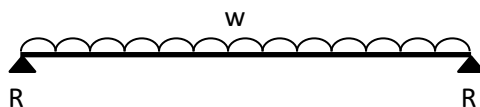
M_{oa} = 6202.89
 α_s = 1.00
 α_m = 1.00

I_x = 86.40 x 10⁶ mm⁴
 Δ_l = 6.13 mm (l / 930)
 Δ_a = 2.41 mm (a / 332)

Adopt: 310UB40

BEAM B8

L = 4.4 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)	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

	<u>w</u>	<u>R</u>
[S] DL	3.30	7.26
[S] LL	1.00	2.20
[U] 1.2DL+1.5LL	5.46	12.01

TRY: 2 / TSF4575 Le = 1.50 m

Check Bending

M* _{mid} =	13.21 kNm	M _{oa} =	61.51
φM _{sx} =	28.27 kNm :: OK	α _s =	0.78
φM _{bx} =	21.97 kNm :: OK	α _m =	1.00

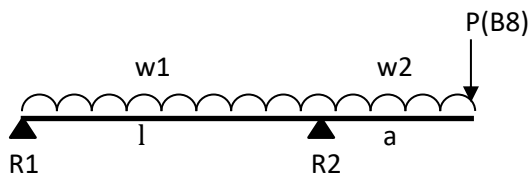
Check Deflection

I _x =	14.00 x 10 ⁶ mm ⁴
Δ _{DL} =	5.75 mm (L / 765)
Δ _{DL+LL} =	7.49 mm (L / 587)

Adopt: 2 / TSF4575

BEAM B9

l = 5.7 m
a = 0.8 m
L = 6.5 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)	1.20 m	0.40 kPa	0.48	0.25 kPa	0.30
Domestic Floor	2.15 m	1.00 kPa	2.15	1.50 kPa	3.23

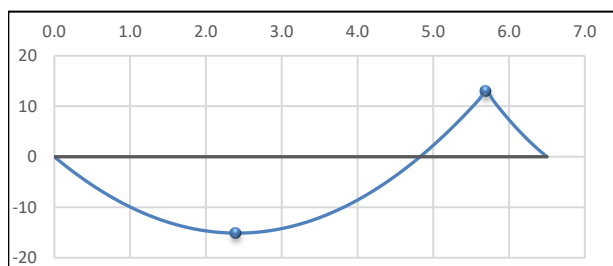
UDL - w2			DL (kN/m)		LL (kN/m)
Wall (L.Weight)	2.70 m	0.60 kPa	1.62		
Roof (Sheet)	1.20 m	0.40 kPa	0.48	0.25 kPa	0.30
Domestic Floor	2.15 m	1.00 kPa	2.15	1.50 kPa	3.23

Design Load Combinations

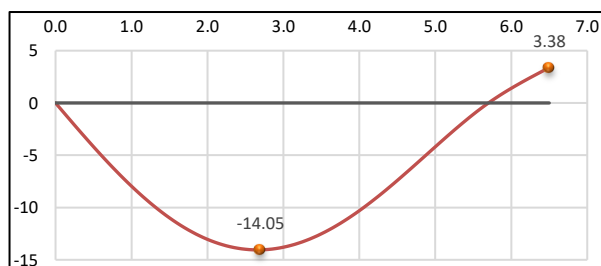
	w1		w2		P	R1	R2
[S]	DL	4.33	DL+LL	7.86	9.40	10.6	29.8
[U]	1.2DL	5.20	1.2DL+1.5LL	10.48	12.00	12.5	37.5

TRY: 2 / TSF4575 Le = 0.6 m

Design Bending Moment



Design Deflection



Design Bending Moments & Deflection

M* = 15.12 kNm
-M* = -12.95 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

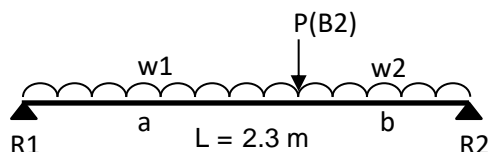
I_x = 14.00 x 10⁶ mm⁴
 Δ_l = 14.05 mm (l / 406)
 Δ_a = 3.38 mm (a / 237)

(entire backspan supported on wall)

Adopt: 2 / TSF4575

LINTEL L1

a = 1.3 m
b = 1.0 m



Design Loads

UDL - w1			DL (kN/m)		LL (kN/m)
Beam S/Weight			0.10		
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

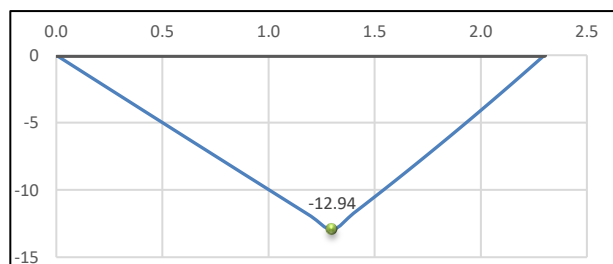
UDL - w2			DL (kN/m)		LL (kN/m)
Wall (L.Weight)	2.70 m	0.60 kPa	1.62		
Roof (Sheet)	0.00 m	0.40 kPa	0.00	0.25 kPa	0.00
Balcony Floor	0.00 m	1.00 kPa	0.00	2.00 kPa	0.00

Design Load Combinations

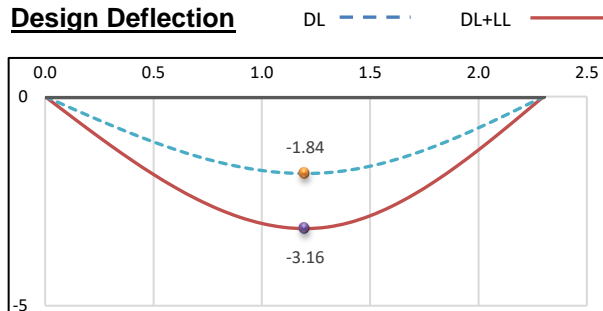
	w1	w2	P	R1	R2
[S] DL	0.10	1.72	9.06	4.4	6.5
[S] LL	0.00	0.00	7.28	3.2	4.1
[U] 1.2DL+1.5LL	0.12	2.06	21.79	10.0	14.0

TRY: 2 / TSF3010 Le = 2.3 m

Design Bending Moment



Design Deflection



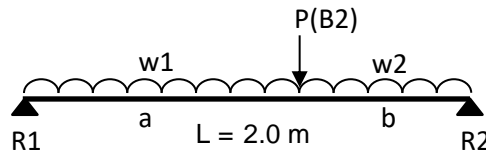
Checks

M* =	12.94 kNm	M _{oa} =	61.19
φM _{sx} =	21.40 kNm :: OK	α _s =	0.83
φM _{bx} =	17.80 kNm :: OK	α _m =	1.00
I _x =	6.85 x 10 ⁶ mm ⁴		
Δ _{DL} =	1.84 mm (L / 1250)		
Δ _{DL+LL} =	3.16 mm (L / 728)		

Adopt: 2 / TSF3010 Or 2/C20015 (boxed)

LINTEL L2

a = 1.5 m
b = 0.5 m



Design Loads

UDL - w1			DL (kN/m)		LL (kN/m)
Beam S/Weight			0.35		
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

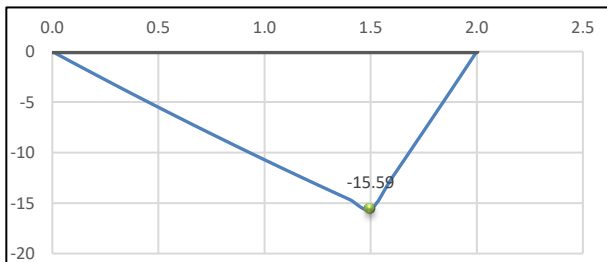
UDL - w2			DL (kN/m)		LL (kN/m)
Wall (Brick Vnr)	0.70 m	2.40 kPa	1.68		
Roof (Sheet)	0.00 m	0.40 kPa	0.00	0.25 kPa	0.00
Balcony Floor	0.00 m	1.00 kPa	0.00	2.00 kPa	0.00

Design Load Combinations

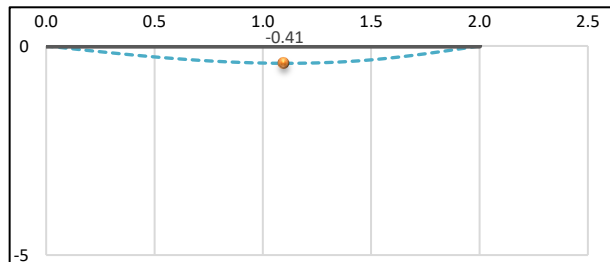
	w1	w2	P	R1	R2
[S] DL + LL	1.07	2.03	30.00	8.6	24.0
[U] 1.2DL+1.5LL	1.28	2.44	40.00	11.4	31.8

TRY: 250PFC Le = 1.5 m

Design Bending Moment



Design Deflection

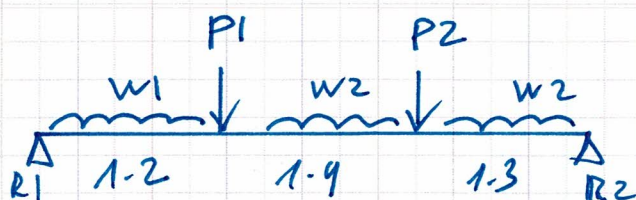


Checks

M* =	15.59 kNm	M _{oa} =	401.37
φM _{sx} =	114.00 kNm :: OK	α _s =	0.87
φM _{bx} =	98.84 kNm :: OK	α _m =	1.00
I _x =	45.10 x 10 ⁶ mm ⁴		
Δ =	0.41 mm (L / 4878)		

Adopt: 250PFC Or 2/C20015 (boxed)

Lintel L3



$$W_{1DL} = 0.7 \times 2.4 \text{ kPa} + 0.4 = 2.1 \text{ kN/m}$$

$$\Rightarrow W_{1DL}^* = 2.5 \text{ kN/m}$$

$$W_{2DL} = 0.3 \times 2.4 \text{ kPa} + 3.2 \times 0.4 \text{ kPa} + 0.4 = 2.4 \text{ kN/m}$$

$$W_{2LL} = 3.2 \times 0.25 = 0.8 \text{ kN/m}$$

$$\Rightarrow W_2 = 3.2 \text{ kN/m} ; W_2^* = 4.1 \text{ kN/m}$$

$$P1 : B7 \rightarrow R1 : 23.7 \text{ kN} ; R1^* = 31.2 \text{ kN}$$

$$P2 : B6 \rightarrow R : 9.1 \text{ kN} ; R^* = 11.8 \text{ kN}$$

Deflection 5.0mm using 250 PFC (for detailing)

$$M^* = 37 \text{ kNm}$$

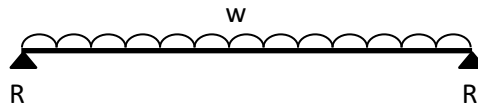
$$L_e = 1.4 \text{ m} \Rightarrow \phi M_{bx} = 100.1 \text{ kNm}$$

\therefore Adopt 250 PFC

$$\left(\begin{array}{ll} R1 = 24.5 \text{ kN} & R2 = 19 \text{ kN} \\ R1^* = 32.0 \text{ kN} & R2^* = 25 \text{ kN} \end{array} \right)$$

BEAM RB1

L = 3.4 m



Design Loads

			<u>DL (kN/m)</u>		<u>LL (kN/m)</u>
Beam S/Weight			0.10		
Wall (L.Weight)	0.00 m	0.60 kPa	0.00		
Roof (Sheet)	1.40 m	0.40 kPa	0.56	0.25 kPa	0.35
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	0.66	1.12
[S] LL	0.35	0.60
[U] 1.2DL+1.5LL	1.32	2.24

TRY: 150x50x3.0 RHS Le = 1.20 m

Check Bending

M* _{mid} =	1.90 kNm	M _{oa} =	294.15
φM _{sx} =	16.20 kNm :: OK	α _s =	1.00
φM _{bx} =	16.20 kNm :: OK	α _m =	1.00

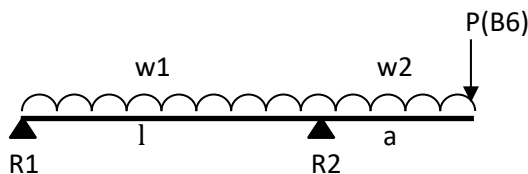
Check Deflection

I _x =	2.99 x 10 ⁶ mm ⁴	
Δ _{DL} =	1.92 mm	(L / 1770)
Δ _{DL+LL} =	2.94 mm	(L / 1157)

Adopt: 150x50x3.0 RHS

BEAM RB2

l = 3.0 m
a = 1.5 m
L = 4.5 m



Design Loads

UDL - w1

Beam S/Weight

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

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
Domestic Floor	0.00 m	1.00 kPa	0.00	1.50 kPa

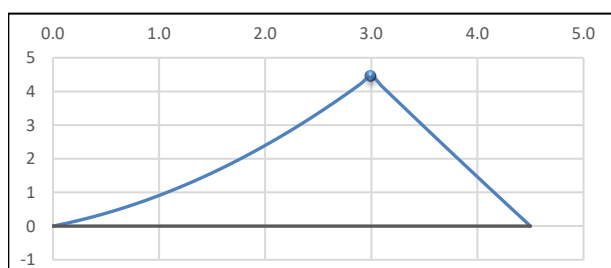
Design Load Combinations

	w1		w2		P	R1	R2
[S]	DL	0.48	DL+LL	0.08	2.50	-0.6	4.6
[U]	1.2DL	0.58	1.2DL+1.5LL	0.10	2.90	-0.6	5.4

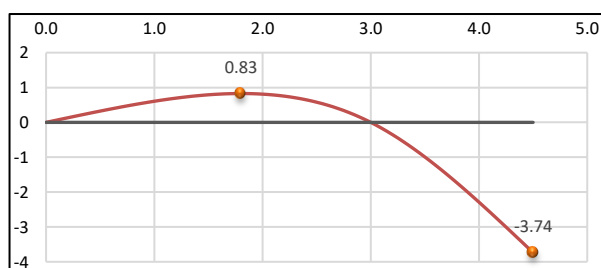
TRY: 2 / TSF4075

Le = 1.2 m

Design Bending Moment



Design Deflection



Design Bending Moments & Deflection

M* = 0.00 kNm
-M* = -4.46 kNm
 ϕM_{sx} = 23.80 kNm :: OK
 ϕM_{bx} = 20.46 kNm :: OK

M_{oa} = 79.95
 α_s = 0.86
 α_m = 1.00

I_x = 10.45 x 10⁶ mm⁴
 Δ_l = 0.83 mm (l / 3614)
 Δ_a = 3.74 mm (a / 401)

Adopt:

2 / TSF4075

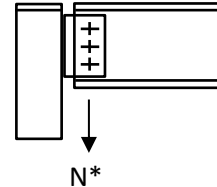
Or 2/C20015 (boxed)

COLUMN C1

Height = 2.5 m

Loads

$N^* = 52.50$ kN
 $N_e^* = 52.50$ kN
 $M_e^* = 7.59$ kNm (e = 0.145 m)



TRY: 89x89x3.5 SHS

Properties

$\phi N_s = 364.0$ kN (for $l_e = 2.5$ m)
 $\phi N_{cy} = 257.0$ kN
 $\phi M_{sx} = 11.5$ kNm
 $\phi M_{bx} = 11.5$ kNm

Check section capacity

$$\frac{M_e^*}{\phi M_s} + \frac{N^*}{\phi N_s} = 0.80 < 1.0, \text{ therefore OK}$$

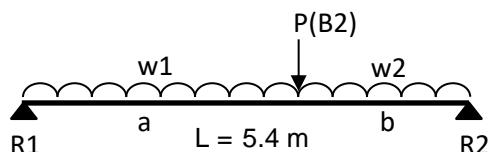
Check member capacity

$$\frac{M_e^*}{\phi M_b} + \frac{N^*}{\phi N_c} = 0.86 < 1.0, \text{ therefore OK}$$

Adopt: 89x89x3.5 SHS

BEAM PF1

a = 4.4 m
b = 1.0 m



Design Loads

UDL - w1			DL (kN/m)		LL (kN/m)
Beam S/Weight			0.35		
Wall (L.Weight)	1.50 m	0.60 kPa	0.90		
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

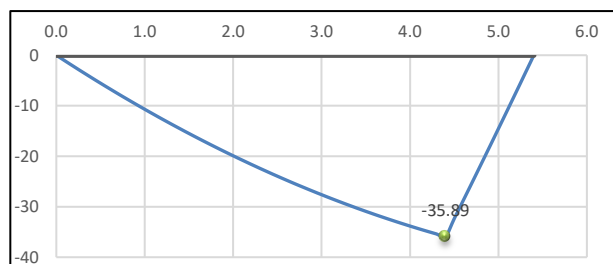
UDL - w2			DL (kN/m)		LL (kN/m)
Wall (L.Weight)	1.50 m	0.60 kPa	0.90		
Roof (Sheet)	0.00 m	0.40 kPa	0.00	0.25 kPa	0.00
Balcony Floor	0.00 m	1.00 kPa	0.00	2.00 kPa	0.00

Design Load Combinations

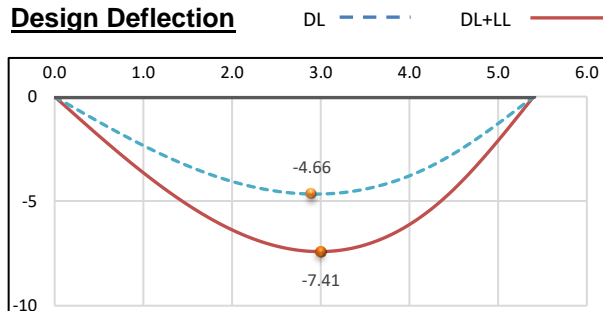
	w1	w2	P	R1	R2
[S] DL	1.25	1.25	16.00	6.3	16.4
[S] LL	0.00	0.00	14.00	2.6	11.4
[U] 1.2DL+1.5LL	1.50	1.50	40.00	11.5	36.6

TRY: 250PFC Le = 3.4 m

Design Bending Moment



Design Deflection



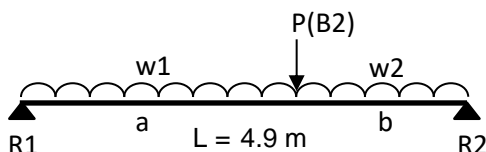
Checks

M* =	35.89 kNm	M _{oa} =	125.04
φM _{sx} =	114.00 kNm :: OK	α _s =	0.60
φM _{bx} =	67.96 kNm :: OK	α _m =	1.00
I _x =	45.10 x 10 ⁶ mm ⁴		
Δ _{DL} =	4.66 mm (L / 1159)		
Δ _{DL+LL} =	7.41 mm (L / 729)		

Adopt: 250PFC

BEAM PF2

a = 4.1 m
b = 0.8 m



Design Loads

UDL - w1			DL (kN/m)		LL (kN/m)
Beam S/Weight			0.35		
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

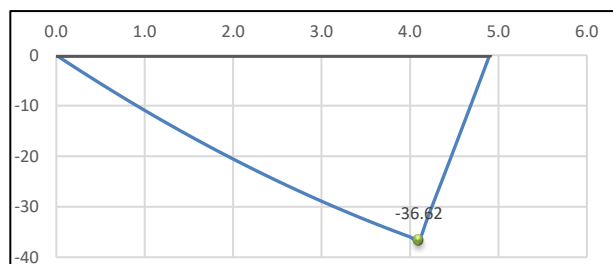
UDL - w2			DL (kN/m)		LL (kN/m)
Wall (Brick Vnr)	0.70 m	2.40 kPa	1.68		
Roof (Sheet)	0.00 m	0.40 kPa	0.00	0.25 kPa	0.00
Balcony Floor	0.00 m	1.00 kPa	0.00	2.00 kPa	0.00

Design Load Combinations

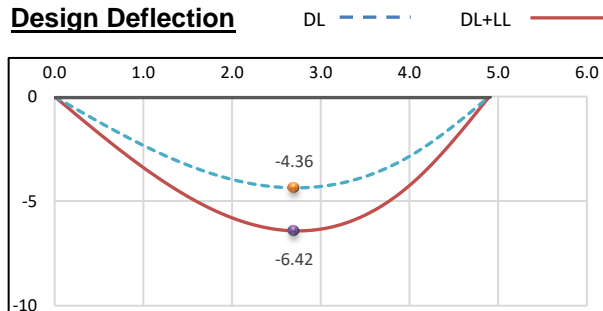
	w1	w2	P	R1	R2
[S] DL	1.07	2.03	26.20	7.0	25.2
[S] LL	0.00	0.00	15.70	2.6	13.1
[U] 1.2DL+1.5LL	1.28	2.44	51.10	11.6	46.7

TRY: 250PFC Le = 4.1 m

Design Bending Moment



Design Deflection

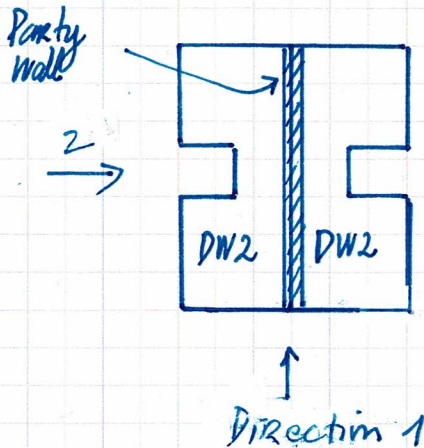


Checks

M* =	36.62 kNm	M _{oa} =	99.67
φM _{sx} =	114.00 kNm :: OK	α _s =	0.53
φM _{bx} =	60.02 kNm :: OK	α _m =	1.00
I _x =	45.10 x 10 ⁶ mm ⁴		
Δ _{DL} =	4.36 mm (L / 1124)		
Δ _{DL+LL} =	6.42 mm (L / 763)		

Adopt: 250PFC

Ground Floor Bracing.



1) Bracing for wind load in direction 1
Refer to TSF details.

2) Bracing for wind load in direction 2

As party wall runs full length of both dwellings 1 & 2 (shaftlines in between), two dwellings assumed to act as one for stability under

wind load in direction 2.

{ Wind speed N1

{ Roof pitch $18^\circ \Rightarrow p = 0.52 \text{ kPa ult. (AS 4055)}$
(net) (Table S.2-S.13)

Racking force:

contributing area = 100 m^2

$$\Rightarrow F_R = 100 \times 0.52 = 52 \text{ kN ult.}$$

i) Hardie-Brace (5mm thick, 5.4 kN/m)

$1.5 \text{ m}, 1.2 \text{ m}, 0.9 \text{ m} \rightarrow 3.7 \text{ m total}$
 $\rightarrow 3.7 \times 5.4 = 20 \text{ kN ult.}$

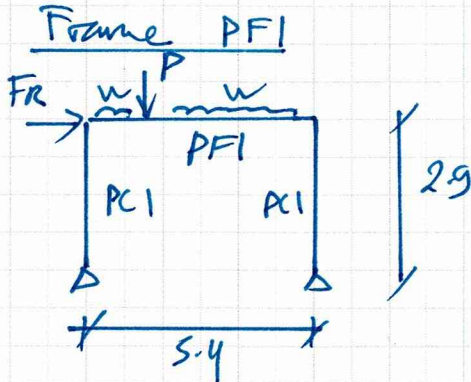
2 dwellings $\Rightarrow \text{Remaining} = 12 \text{ kN ult.}$

ii) Portal frame

Total capacity: 14 kN (Refer to Portal Frame Calculations)

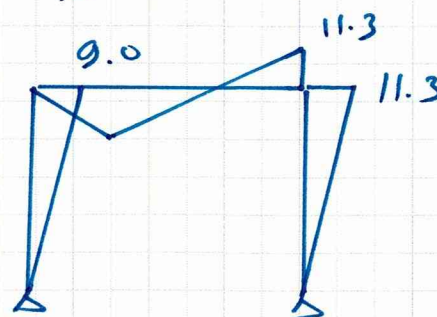
\therefore Bracing achieved 54 kN required

Portal Frame



$$P_{DL}^* = 19.2 \text{ kN} \quad F_R^* = 7.0 \text{ kN}$$

$$W_{DL}^* = 1.5 \text{ kN/m}$$



$$M^* = 11.3 \text{ (RHS)}$$

$$M^* = 9.0 \text{ (LHS)}$$

17 Check PCI: member capacity

$$DL + LL : N^* = 37 \text{ kN} \quad e = 0.145 \text{ m} \quad \Rightarrow M_e^* = 5.4 \text{ kNm}$$

$$\frac{M_e^*}{\phi M_s} + \frac{N^*}{\phi N_{cy}} = \frac{5.4}{17.9} + \frac{37}{324} = 0.41 < 1.0 \quad \therefore \text{OK}$$

(L = 3.0m)

$$DL + WL : \quad (LHS)$$

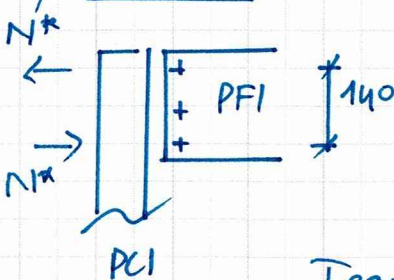
$$N^* = 19.7 \quad \Rightarrow M_e^* = 2.4$$

$$M_{\text{Total}} = 2.4 + 9.0 = 11.4 \text{ kNm} \quad (RHS) \quad N^* = 7.6 \text{ kN} \quad \Rightarrow M^*_{\text{Total}} = 12.4$$

$$(LHS) \Rightarrow \frac{M^*_{\text{Total}}}{\phi M_s} + \frac{N^*}{\phi N_{cy}} = \frac{11.4}{17.9} + \frac{19.7}{95.7} = 0.84 \quad \therefore \text{OK}$$

(L = 6.0m)

27 Connection



$$\text{Max } N^* = 12.4 / 0.14 = 89 \text{ kN} \quad (\rightarrow)$$

$$\Rightarrow \text{use } 2 \text{ M20 } 8.8/S$$

$$\text{Max } N^*_{DL} = 37 \text{ kN} (\uparrow) \Rightarrow \text{provide additional } 1 \text{ M20}$$

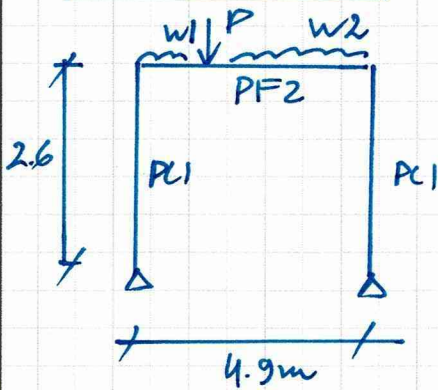
$$\text{Tear-out cap of } 8 \text{ mm web} = 127 \text{ kN} \therefore \text{OK}$$

(250 PFC)

$$\therefore \text{Adopt } \left\{ \begin{array}{l} 89 \times 60 \text{ SHS, } 10 \text{ mm base pl, } 2 \text{ M16 clenset anchors} \\ 250 \text{ PFC, } 10 \text{ mm cleat, } 3 \text{ M20 } 8.8/S \end{array} \right.$$

Portal Frame (Cont.)

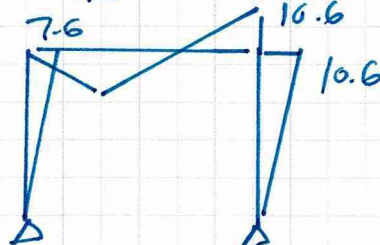
Frame PF2



$$P_{DL}^* = 1.2 \times 26.2 = 31.4 \text{ kN}$$

$$w_{1DL}^* = 2.4 \text{ kN/m}$$

$$w_{2DL}^* = 1.3 \text{ kN/m}$$



$$M^* = 10.6 \text{ (RHS)}$$

$$M^* = 7.6 \text{ (LHS)}$$

17 Check PC1:

$$DL + LL : N^* = 46.7 \text{ kN} \rightarrow M_e^* =$$

$$\frac{M_e^*}{\phi M_{ys}} + \frac{N^*}{\phi N_{cy}} = 0.46 < 1.0 \therefore \text{OK}$$

($L_e = 2.5 \text{ m}$)

$$DL + WL : \begin{cases} (LHS) \left\{ \begin{aligned} N_{DL}^* &= 30.2 \text{ kN} \rightarrow M_e^* = 4.4 \\ &\Rightarrow M_{total}^* = 12 \text{ kNm} \end{aligned} \right. \end{cases}$$

$$\begin{cases} (RHS) \left\{ \begin{aligned} M_{DL}^* &= 8.4 \text{ kNm} \rightarrow M_e^* = 1.2 \\ &\Rightarrow M_{total}^* = 11.8 \text{ kNm} \end{aligned} \right. \end{cases}$$

$$(LHS) \Rightarrow \frac{M^*}{\phi M_{ys}} + \frac{N^*}{\phi N_{cy}} = 0.98 < 1.0 \therefore \text{OK}$$

($L_e = 6.0$)

27 Connection

$$\text{Max } N^* = 12 / 0.14 = 85 \text{ kN} (\rightarrow) \rightarrow 2M20 \text{ 8-8/s}$$

$$\text{Max } M_{DL}^* = 46.7 \text{ kNm} (\downarrow) \rightarrow 1M20 \text{ 8-8/s}$$

$$\text{tear out cap. 250 PFC web (8mm)} = 127 \text{ kN} \therefore \text{OK}$$

\therefore Adopt $\left\{ \begin{aligned} &89 \times 6.0 \text{ SHS, 10mm base pl., 2M16 chemset anchors} \\ &250 \text{ PFC, 10mm cleat, 3M20 8-8/s.} \end{aligned} \right.$