

APB Building Surveyors

1 Maple Grove, Ramsbottom. BL0 0AN

Site: 3 Becon View. Longridge

Job: Extension

Job number: 08/002

SuperBeam 7.00e 440570

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SuperBeam Project Summary

Project started 16 Aug 2016 APB

Site address: 3 Becon View. Longridge

Job: Extension

Client: Mr Guisef

Job number: 08/002

320160797P

ITEMS:

- 1: Beam: Beam A (Conservatory Side)
Span: 4.182 m. Reactions: R1: 45.99 kN R2: 45.99 kN
Use 2No 203 x 133 x 25 UB S355
Bearing R1: Not specified
Bearing R2: 450 x 100 mm padstone

Sections to be bolted together with tube spacers or suitable alternative connection at max 1.5m c/s

- 2: Beam: Beam B (Box Gutter)
Span: 4.473 m. Reactions: R1: 10.84 kN R2: 10.84 kN
Use 150 x 90 x 24 PFC S355
Bearing R1: 100 x 100 mm padstone
Bearing R2: As R1

- 3: Beam: Beam C (Kitchen)
Span: 3.05 m. Reactions: R1: 25.79 kN R2: 25.79 kN
Use 2No 152 x 89 x 16 UB S355
Bearing R1: 250 x 100 mm padstone
Bearing R2: As R1

Sections to be bolted together with tube spacers or suitable alternative connection at max 1.5m c/s

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Beam: Beam A (Conservatory Side)

Span: 4.182 m.

Load name	Loading w1	Start x1	Loading w2	End x2	R1comp	R2comp
U D o.w.	0.5	0		L	1.05	1.05
U L Wall	3.3X3.75	0		L	25.88	25.88
U L Floor	1.886x2.25	0		L	8.87	8.87
U L Roof	2.168x2.25	0		L	10.20	10.20
Total load: 91.99 kN					45.99	45.99
					Dead:	1.05
					Live:	44.95

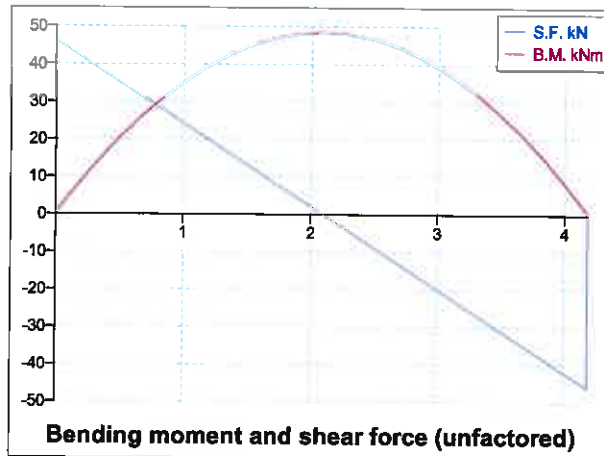
Load types: U: UDL D: Dead; L: Live (positions in m. from R1)

Maximum B.M. = 48.09 kNm at 2.09 m. from R1

Maximum S.F. = 45.99 kN at 0.00 m. from R1

Live load deflection = $85.6 \times 10^8/EI$ at 2.09 m. from R1 (E in N/mm^2 , I in cm^4)

Total deflection = $87.6 \times 10^8/EI$ at 2.09 m. from R1



Steel beam calculation to BS440 Part 2 using S355 steel

SECTION SIZE : 2No 203 x 133 x 25 UB S355

D=203.2 mm B=133.2 mm t=5.7 mm T=7.8 mm $I_x=2,340 \text{ cm}^4$ $r_y=3.10 \text{ cm}$ $Z_x=230 \text{ cm}^3$ (per section)

Bending: $L_E/r_y = 4.18 \times 100/3.10 = 135$ $D/T = 26.1$

Permissible bending stress, $p_{bc} = 115.3 \text{ N/mm}^2$ (Table 3b)

Actual bending stress, $f_{bc} = 48.1 \times 1000/(2 \times 230.0) = 104.5 \text{ N/mm}^2$ OK

Shear: Maximum shear in web, $f_s = 46.0 \times 1000/(2 \times 5.7 \times 203.2) = 19.9 \text{ N/mm}^2$ OK

Beam web: Check unstiffened web capacity with load of $45.99/2 = 23.00 \text{ kN}$

Bearing: $p_h = 260 \text{ N/mm}^2$ (Table 9); $C1 = 39.5 \text{ kN}$; $C2 = 1.48 \text{ kN/mm}$

Buckling: $p_c = 181 \text{ N/mm}^2$ (Table 17b); $C1 = 105 \text{ kN}$; $C2 = 1.03 \text{ kN/mm}$

Minimum required stiff bearing length, $L_h = 0 \text{ mm}$

Bearing capacity, $P_w = C1 + L_h.C2 = 39.5 \text{ kN} \lll$

Buckling capacity, $P_x = C1 + L_b.C2 = 105 \text{ kN}$

Deflection: Live load deflection = $85.6 \times 1e8/(2 \times 205,000 \times 2,340) = 8.9 \text{ mm}$ (L/469) OK

Total deflection = $87.6 \times 1e8/(2 \times 205,000 \times 2,340) = 9.1 \text{ mm}$ (L/458)

Combined bending and shear check (14.c): $(f_{bc}/p_{bc})^2 + (f_s/p_s)^2 = 0.822$ at 2.09 m. (≤ 1.25 OK)

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Bearings

203 x 133 x 25 UB stiff bearing length, $b_1 = t + 1.6r + 2T = 33.5$ mm; O/A b_1 taken as 166.7 mm

R1: None

R2: 450 x 100 mm padstone

Factored reaction = $1.05 \times 1.4 + 44.95 \times 1.6 = 73.38$ kN

Masonry: 100mm 7N/mm² solid block (SF>2.0), class (iii) mortar, normal const/normal mfr

Local design strength (factored) = $6.2/3.5 = 1.77$ N/mm² (BS5628-1:2005 Table 2d/2e)

Factored stress under padstone = $73.38 \times 1000/450 \times 100 = 1.63$ N/mm²

Sections to be bolted together with tube spacers or suitable alternative connection at max 1.5m c/s

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Beam: Beam B (Box Gutter)

Span: 4.473 m.

Load name	Loading w1	Start x1	Loading w2	End x2	R1comp	R2comp
U D o.w.	0.3	0		L	0.67	0.67
U L Roof	2.273x2	0		L	10.17	10.17
Total load: 21.68 kN					10.84	10.84
Dead:					0.67	0.67
Live:					10.17	10.17

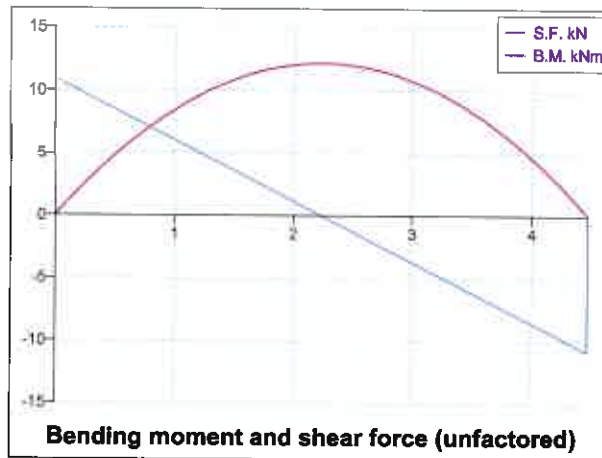
Load types: U: UDL D: Dead; L: Live (positions in m. from R1)

Maximum B.M. = 12.12 kNm at 2.24 m. from R1

Maximum S.F. = 10.84 kN at 0.00 m. from R1

Live load deflection = $23.7 \times 10^8/EI$ at 2.24 m. from R1 (E in N/mm^2 , I in cm^4)

Total deflection = $25.3 \times 10^8/EI$ at 2.24 m. from R1



Steel beam calculation to BS449 Part 2 using S355 steel

SECTION SIZE : 150 x 90 x 24 PFC S355

$D=150.0$ mm $B=90.0$ mm $t=6.5$ mm $T=12.0$ mm $I_x=1,160$ cm⁴ $r_y=2.89$ cm $Z_x=155$ cm³

Bending: $L_E/r_y = 4.47 \times 100/2.89 = 155$ $D/T = 12.5$

Permissible bending stress, $p_{bc} = 151.1$ N/mm² (Table 3b)

Actual bending stress, $f_{bc} = 12.1 \times 1000/155.0 = 78.2$ N/mm² OK

Shear: Maximum shear in web, $f_s = 10.8 \times 1000/(6.5 \times 150.0) = 11.1$ N/mm² OK

Web buckling and crushing have not been checked

Deflection: Live load deflection = $23.7 \times 1e8/(205,000 \times 1,160) = 10.0$ mm (L/449) OK

Total deflection = $25.3 \times 1e8/(205,000 \times 1,160) = 10.6$ mm (L/421)

Combined bending and shear check (14.c): $(f_{bc}/p_{bc})^2 + (f_s/p_s)^2 = 0.268$ at 2.24 m. (≤ 1.25 OK)

Bearings

150 x 90 x 24 PFC stiff bearing length, $b_1 = t + 0.8r + T = 28.1$ mm

Masonry: 100mm 7N/mm² solid block (SF>2.0), class (iii) mortar, normal const/normal mfr

Local design strength (factored) = $6.2/3.5 = 1.77$ N/mm² (BS5628-1:2005 Table 2d/2e)

R1: 100 x 100 mm padstone

Factored reaction = $0.67 \times 1.4 + 10.17 \times 1.6 = 17.21$ kN

Factored stress under padstone = $17.21 \times 1000/100 \times 100 = 1.72$ N/mm²

R2 as R1

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Beam: Beam C (Kitchen)

Span: 3.05 m.

	Load name	Loading w1	Start x1	Loading w2	End x2	R1comp	R2comp	
U D	o.w.	0.4	0		L	0.61	0.61	
U L	Wall	2.620x3.75	0		L	14.98	14.98	
U L	Floor	1.344x2	0		L	4.10	4.10	
U L	Roof	2x2	0		L	6.10	6.10	
Total load: 51.58 kN						25.79	25.79	
						Dead:	0.61	0.61
						Live:	25.18	25.18

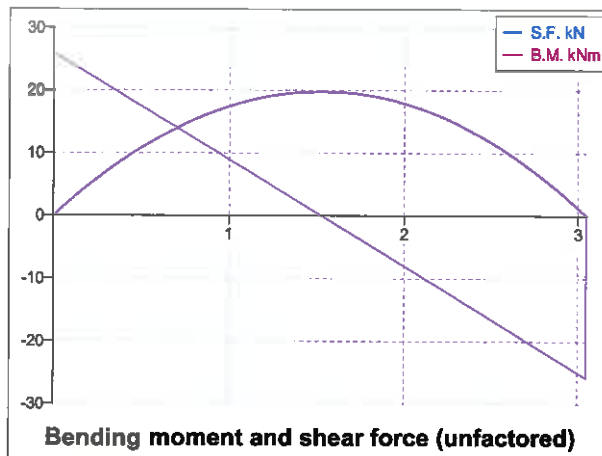
Load types: U: UDL D: Dead; L: Live (positions in m. from R1)

Maximum B.M. = 19.67 kNm at 1.52 m. from R1

Maximum S.F. = 25.79 kN at 0.00 m. from R1

Live load deflection = $18.6 \times 10^8/EI$ at 1.52 m. from R1 (E in N/mm^2 , I in cm^4)

Total deflection = $19.1 \times 10^8/EI$ at 1.52 m. from R1



Steel beam calculation to BS449 Part 2 using S355 steel

SECTION SIZE : 2No 152 x 89 x 16 UB S355

$D=152.4$ mm $B=88.7$ mm $t=4.5$ mm $T=7.7$ mm $I_x=834$ cm⁴ $r_y=2.10$ cm $Z_x=109$ cm³ (per section)

Bending: $L_E/r_y = 3.05 \times 100/2.10 = 145$ $D/T = 19.8$

Permissible bending stress, $p_{bc} = 122.2$ N/mm² (Table 3b)

Actual bending stress, $f_{bc} = 19.7 \times 1000/(2 \times 109.0) = 90.2$ N/mm² OK

Shear: Maximum shear in web, $f_s = 25.8 \times 1000/(2 \times 4.5 \times 152.4) = 18.8$ N/mm² OK

Beam web: Check unstiffened web capacity with load of $25.79/2 = 12.90$ kN

Bearing: $p_b = 260$ N/mm² (Table 9); $C1 = 31.0$ kN; $C2 = 1.17$ kN/mm

Buckling: $p_c = 187$ N/mm² (Table 17b); $C1 = 64.2$ kN; $C2 = 0.842$ kN/mm

Minimum required stiff bearing length, $L_b = 0$ mm

Bearing capacity, $P_w = C1 + L_b.C2 = 31.0$ kN <<<

Buckling capacity, $P_x = C1 + L_b.C2 = 64.2$ kN

Deflection: Live load deflection = $18.6 \times 1e8/(2 \times 205,000 \times 834) = 5.4$ mm (L/561) OK

Total deflection = $19.1 \times 1e8/(2 \times 205,000 \times 834) = 5.6$ mm (L/547)

Combined bending and shear check (14.c): $(f_{bc}/p_{bc})^2 + (f_s/p_s)^2 = 0.545$ at 1.52 m. (≤ 1.25 OK)

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Bearings

152 x 89 x 16 UB stiff bearing length, $b_1 = t + 1.6r + 2T = 32.1$ mm; O/A b_1 taken as 120.8 mm

Masonry: 100mm 7N/mm^2 solid block ($\text{SF} > 2.0$), class (iii) mortar, normal const/normal mfr

Local design strength (factored) = $6.2/3.5 = 1.77\text{N/mm}^2$ (BS5628-1:2005 Table 2d/2e)

R1: 250 x 100 mm padstone

Factored reaction = $0.61 \times 1.4 + 25.18 \times 1.6 = 41.15$ kN

Factored stress under padstone = $41.15 \times 1000/250 \times 100 = 1.65$ N/mm²

R2 as R1

Sections to be bolted together with tube spacers or suitable alternative connection at max 1.5m c/s