

PLAN AND DESIGN

Site: 187b Woodrow Road
Job: LOft Conversion and Rear ext
Job number: 1483

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SuperBeam Project Summary

Project started 18 Oct 2025 PR
Site address: 187b Woodrow Road
Job: LOft Conversion and Rear ext
Client: Parker
Job number: 181025

ITEMS:

- 1:

Beam: Beam 1

Span: 3.6 m. Reactions: R1: 24.48 kN R2: 24.48 kN

Use 2No 203 x 133 x 30 UB S355 (Grade 50)

Bearing R1: 550 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
- 2:

Beam: Beam 2

Span: 2.4 m. Reactions: R1: 3.96 kN R2: 3.96 kN

Use 178 x 102 x 19 UB S355 (Grade 50)

Bearing R1: 102 x 100 mm padstone

Bearing R2: As R1
- 3:

Beam: Beam 3

Span: 3.6 m. Reactions: R1: 27.54 kN R2: 27.54 kN

Use 203 x 133 x 30 UB S355 (Grade 50)

Bearing R1: 650 x 100 mm padstone

Bearing R2: As R1
- 4:

Beam: Beam 4

Span: 2.357 m. + 1.24 m. RH cantilever Reactions: R1: 13.02 kN R2: 42.06 kN

Use 203 x 133 x 30 UB S355 (Grade 50)

Bearing R1: 300 x 100 mm padstone

Bearing R2: 950 x 100 mm padstone
- 5:

Beam: Beam 5

Span: 3.6 m. Reactions: R1: 27.54 kN R2: 27.54 kN

Use 203 x 133 x 30 UB S355 (Grade 50)

Bearing R1: 650 x 100 mm padstone

Bearing R2: As R1
- 6:

Beam: Beam 6

Span: 1.74 m. + 1.86 m. RH cantilever Reactions: R1: -1.90 kN R2: 56.98 kN

Use 203 x 133 x 30 UB S355 (Grade 50)

Bearing R1: 300 x 100 mm padstone

Bearing R2: 1300 x 100 mm padstone

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Beam: Beam 1

Span: 3.6 m.

	Load name	Loading w1	Start x1	Loading w2	End x2	R1comp	R2comp
U T	o.w.	0.6	0		L	1.08	1.08
U T	Roof Load	10.0	0		L	18.00	18.00
U T	Roof Load proposed	3.0	0		L	5.40	5.40
						<u>24.48</u>	<u>24.48</u>

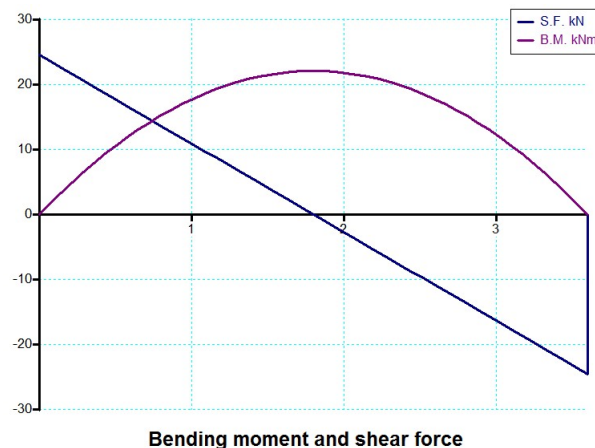
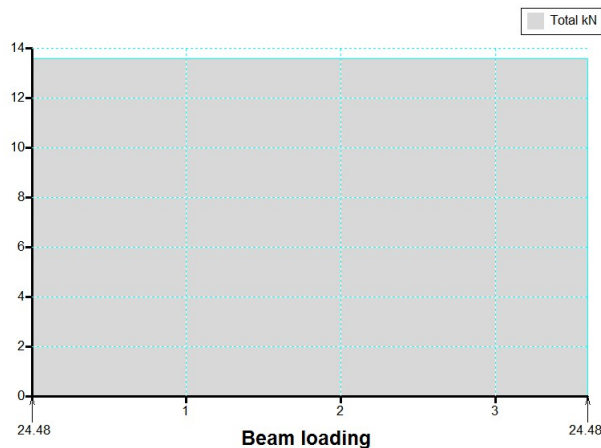
Total load: 48.96 kN

Load types: U: UDL T: Total (positions in m. from R1)

Maximum B.M. = 22.03 kNm at 1.80 m. from R1

Maximum S.F. = 24.48 kN at 0.00 m. from R1

Total deflection = $29.7 \times 10^8 / EI$ at 1.80 m. from R1 (E in N/mm^2 , I in cm^4)



Steel beam calculation to BS449 Part 2 using S355 (Grade 50) steel

SECTION SIZE : 2No 203 x 133 x 30 UB S355 (Grade 50)

$D=206.8$ mm $B=133.9$ mm $t=6.4$ mm $T=9.6$ mm $I_x=2,900$ cm⁴ $r_y=3.17$ cm $Z_x=280$ cm³ (per section)

Bending: $L_E/r_y = 3.60 \times 100/3.17 = 114$ $D/T = 21.5$

Permissible bending stress, $p_{bc} = 148.1$ N/mm² (Table 3b)

Actual bending stress, $f_{bc} = 22.03 \times 1000/(2 \times 280.0) = 39.3$ N/mm² OK

Shear: Maximum shear in web, $f_s = 24.48 \times 1000/(2 \times 6.4 \times 206.8) = 9.2$ N/mm² OK

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Beam web: Check unstiffened web capacity with load of $24.48/2 = 12.24$ kN

Bearing: $p_b = 260\text{N/mm}^2$ (Table 9); $C1 = 49.6$ kN; $C2 = 1.66$ kN/mm

Buckling: $p_c = 187\text{N/mm}^2$ (Table 17b); $C1 = 124$ kN; $C2 = 1.20$ kN/mm

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

Bearing capacity, $P_w = C1 + L_b.C2 = 49.6\text{kN} \lll$

Buckling capacity, $P_x = C1 + L_b.C2 = 124\text{kN}$

Total deflection = $29.7 \times 1e8 / (2 \times 205,000 \times 2,900) = 2.5$ mm (L/1439) OK

Combined bending and shear check (14.c): $(f_{bc}/p_{bc})^2 + (f_s/p_s)^2 = 0.071$ at 1.80 m. (≤ 1.25 OK)

Bearings

203 x 133 x 30 UB stiff bearing length, $b_1 = t + 1.6r + 2T = 37.8$ mm; O/A b_1 taken as 171.7 mm

Factor reactions by 1.55 (user selected value)

Local design strength of masonry (factored) = 0.700 N/mm^2 (User-entered value)

R1: 550 x 100 mm padstone

Factored reaction = $24.48 \times 1.55 = 37.94$ kN

Factored stress under padstone = $1.55 \times 24.48 \times 1000 / 550 \times 100 = 0.69\text{ N/mm}^2$

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 2

Span: 2.4 m.

	Load name	Loading w1	Start x1	Loading w2	End x2	R1comp	R2comp
U T	o.w.	0.3	0		L	0.36	0.36
U T	Flat roof dead	3.0	0		L	3.60	3.60
						<u>3.96</u>	<u>3.96</u>

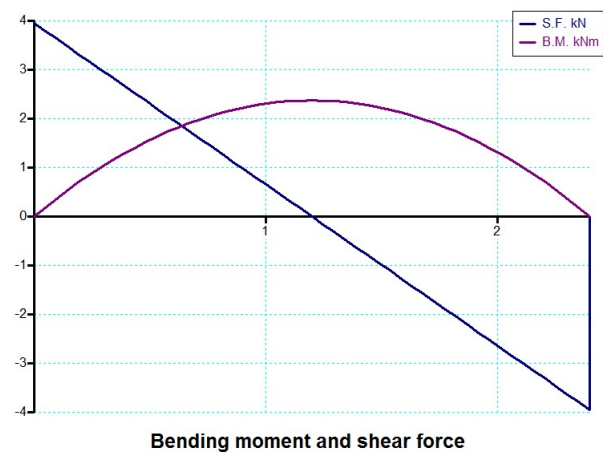
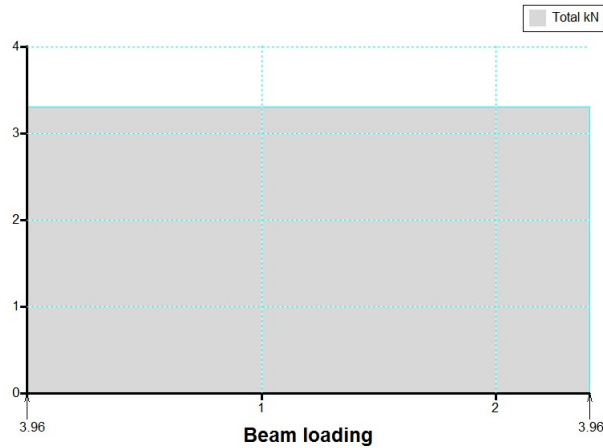
Total load: 7.92 kN

Load types: U: UDL T: Total (positions in m. from R1)

Maximum B.M. = 2.38 kNm at 1.20 m. from R1

Maximum S.F. = 3.96 kN at 0.00 m. from R1

Total deflection = $1.43 \times 10^{-8}/EI$ at 1.20 m. from R1 (E in N/mm^2 , I in cm^4)



Steel beam calculation to BS449 Part 2 using S355 (Grade 50) steel

SECTION SIZE : 178 x 102 x 19 UB S355 (Grade 50)

$D=177.8$ mm $B=101.2$ mm $t=4.8$ mm $T=7.9$ mm $I_x=1,360$ cm⁴ $r_y=2.37$ cm $Z_x=153$ cm³

Bending: $L_E/r_y = 2.40 \times 100/2.37 = 101$ $D/T = 22.5$

Permissible bending stress, $p_{bc} = 160.1$ N/mm² (Table 3b)

Actual bending stress, $f_{bc} = 2.38 \times 1000/153.0 = 15.5$ N/mm² OK

Shear: Maximum shear in web, $f_s = 3.96 \times 1000/(4.8 \times 177.8) = 4.6$ N/mm² OK

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Beam web: Check unstiffened web capacity with load of 3.960 kN

Bearing: $p_b = 260 \text{ N/mm}^2$ (Table 9); $C1 = 33.5 \text{ kN}$; $C2 = 1.25 \text{ kN/mm}$

Buckling: $p_c = 180 \text{ N/mm}^2$ (Table 17b); $C1 = 76.8 \text{ kN}$; $C2 = 0.864 \text{ kN/mm}$

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

Bearing capacity, $P_w = C1 + L_b.C2 = 33.5 \text{ kN} \lll$

Buckling capacity, $P_x = C1 + L_b.C2 = 76.8 \text{ kN}$

Total deflection = $1.43 \times 10^8 / (205,000 \times 1,360) = 0.5 \text{ mm (L/4694) OK}$

Combined bending and shear check (14.c): $(f_{bc}/p_{bc})^2 + (f_s/p_s)^2 = 0.009$ at 1.20 m. (≤ 1.25 OK)

Bearings

178 x 102 x 19 UB stiff bearing length, $b_1 = t + 1.6r + 2T = 32.8 \text{ mm}$

Factor reactions by 1.55 (user selected value)

Local design strength of masonry (factored) = 0.700 N/mm^2 (User-entered value)

R1: 102 x 100 mm padstone

Factored reaction = $3.96 \times 1.55 = 6.14 \text{ kN}$

Factored stress under padstone = $1.55 \times 3.96 \times 1000 / 102 \times 100 = 0.60 \text{ N/mm}^2$

R2 as R1

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Beam: Beam 3

Span: 3.6 m.

	Load name	Loading w1	Start x1	Loading w2	End x2	R1comp	R2comp
U T	o.w.	0.3	0		L	0.54	0.54
U T	Roof Load	10.0	0		L	18.00	18.00
U T	Floor Load	5.0	0		L	9.00	9.00
						27.54	27.54

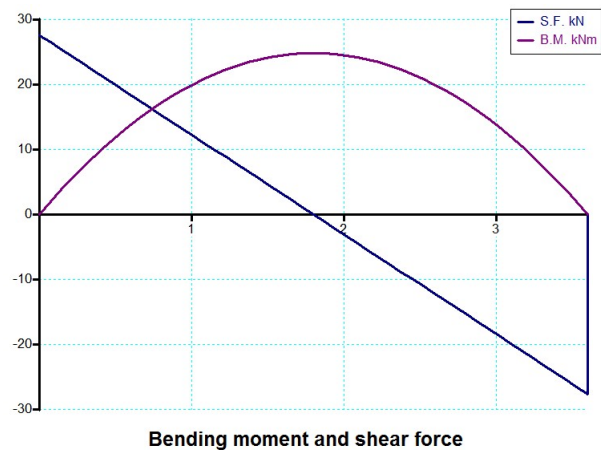
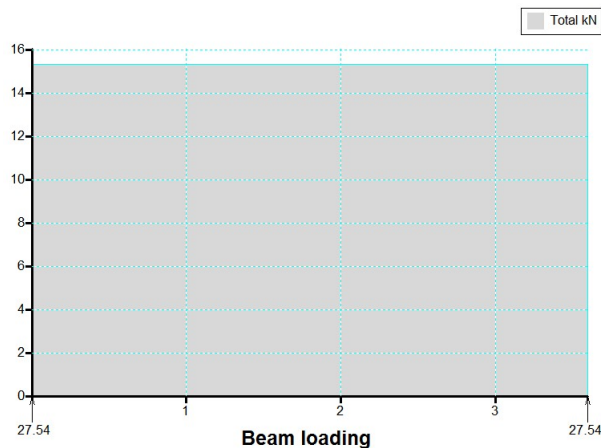
Total load: 55.08 kN

Load types: U: UDL T: Total (positions in m. from R1)

Maximum B.M. = 24.79 kNm at 1.80 m. from R1

Maximum S.F. = 27.54 kN at 0.00 m. from R1

Total deflection = $33.5 \times 10^8 / EI$ at 1.80 m. from R1 (E in N/mm^2 , I in cm^4)



Steel beam calculation to BS449 Part 2 using S355 (Grade 50) steel

SECTION SIZE : 203 x 133 x 30 UB S355 (Grade 50)

D=206.8 mm B=133.9 mm t=6.4 mm T=9.6 mm $I_x=2,900 \text{ cm}^4$ $r_y=3.17 \text{ cm}$ $Z_x=280 \text{ cm}^3$

Bending: $L_E/r_y = 3.60 \times 100/3.17 = 114$ D/T = 21.5

Permissible bending stress, $p_{bc} = 148.1 \text{ N/mm}^2$ (Table 3b)

Actual bending stress, $f_{bc} = 24.79 \times 1000/280.0 = 88.5 \text{ N/mm}^2$ OK

Shear: Maximum shear in web, $f_s = 27.54 \times 1000/(6.4 \times 206.8) = 20.8 \text{ N/mm}^2$ OK

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Beam web: Check unstiffened web capacity with load of 27.54 kN

Bearing: $p_b = 260 \text{ N/mm}^2$ (Table 9); $C1 = 49.6 \text{ kN}$; $C2 = 1.66 \text{ kN/mm}$

Buckling: $p_c = 187 \text{ N/mm}^2$ (Table 17b); $C1 = 124 \text{ kN}$; $C2 = 1.20 \text{ kN/mm}$

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

Bearing capacity, $P_w = C1 + L_b.C2 = 49.6 \text{ kN} \lll$

Buckling capacity, $P_x = C1 + L_b.C2 = 124 \text{ kN}$

Total deflection = $33.5 \times 1e8 / (205,000 \times 2,900) = 5.6 \text{ mm (L/640) OK}$

Combined bending and shear check (14.c): $(f_{bc}/p_{bc})^2 + (f_s/p_s)^2 = 0.357$ at 1.80 m. (≤ 1.25 OK)

Bearings

203 x 133 x 30 UB stiff bearing length, $b_1 = t + 1.6r + 2T = 37.8 \text{ mm}$

Factor reactions by 1.55 (user selected value)

Local design strength of masonry (factored) = 0.700 N/mm^2 (User-entered value)

R1: 650 x 100 mm padstone

Factored reaction = $27.54 \times 1.55 = 42.69 \text{ kN}$

Factored stress under padstone = $1.55 \times 27.54 \times 1000 / 650 \times 100 = 0.66 \text{ N/mm}^2$

R2 as R1

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Beam: Beam 4

Span: 2.357 m.
+ RH Cantilever: 1.243 m.

	Load name	Loading w1	Start x1	Loading w2	End x2	R1comp	R2comp
R T	o.w.	0.3	0		3.6	0.26	0.82
R T	Roof Load	10.0	0		3.6	8.51	27.49
R T	Floor Load	5.0	0		3.6	4.25	13.75
						13.02	42.06

Total load: 55.08 kN

Load types: R: Part UDL T: Total (positions in m. from R1)

Maximum B.M. (span) = -11.76 kNm at 2.36 m. from R1
(RH cantilever) = -11.82 kNm

Maximum S.F. (span) = -23.05 kN at R2
(RH cantilever) = 19.02 kN at R2

Maximum deflection (span) = $2.18 \times 10^8 / EI$ at 0.96 m. from R1
(RH cantilever) = $5.73 \times 10^8 / EI$ (E in N/mm^2 , I in cm^4)

Steel beam calculation to BS449 Part 2 using S355 (Grade 50) steel

SECTION SIZE : 203 x 133 x 30 UB S355 (Grade 50)

D=206.8 mm B=133.9 mm t=6.4 mm T=9.6 mm $I_x=2,900 \text{ cm}^4$ $r_y=3.17 \text{ cm}$ $Z_x=280 \text{ cm}^3$

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Span:

Bending: $L_E/r_y = 2.36 \times 100/3.17 = 74$ $D/T = 21.5$
Permissible bending stress, $p_{bc} = 196.3 \text{ N/mm}^2$ (Table 3b)
Actual bending stress, $f_{bc} = 11.76 \times 1000/280.0 = 42.0 \text{ N/mm}^2$ OK
Shear: Maximum shear in web, $f_s = 23.05 \times 1000/(6.4 \times 206.8) = 17.4 \text{ N/mm}^2$ OK
Deflection: Total deflection = $2.18 \times 1e8/(205,000 \times 2,900) = 0.4 \text{ mm}$ (L/6435) OK

RH cantilever:

Bending: $L_e = 2.5L = 3.11\text{m}$. $L_E/r_y = 3.11 \times 100/3.17 = 98$ $D/T = 21.5$
Permissible bending stress, $p_{bc} = 165.7 \text{ N/mm}^2$ (Table 3b)
Actual bending stress, $f_{bc} = 11.82 \times 1000/280.0 = 42.2 \text{ N/mm}^2$ OK
Shear: Maximum shear in web, $f_s = 19.02 \times 1000/(6.4 \times 206.8) = 14.4 \text{ N/mm}^2$ OK
Deflection: Total deflection = $5.73 \times 1e8/(205,000 \times 2,900) = 1.0 \text{ mm}$ (L/1289) OK

Beam web:

Check unstiffened web capacities with loads of 13.02 kN and 42.06 kN
Bearing: $p_b = 260 \text{ N/mm}^2$ (Table 9); $C1 = 49.6/99.1 \text{ kN}$; $C2 = 1.66 \text{ kN/mm}$
Buckling: $p_c = 187 \text{ N/mm}^2$ (Table 17b); $C1 = 124/248 \text{ kN}$; $C2 = 1.20 \text{ kN/mm}$
R1: Minimum required stiff bearing length, $L_b = 0 \text{ mm}$
Bearing capacity, $P_w = C1 + L_b.C2 = 49.6 \text{ kN} <<<$
Buckling capacity, $P_x = C1 + L_b.C2 = 124 \text{ kN}$
R2: Minimum required stiff bearing length, $L_b = 0 \text{ mm}$
Bearing capacity, $P_w = C1 + L_b.C2 = 99.1 \text{ kN} <<<$
Buckling capacity, $P_x = C1 + L_b.C2 = 248 \text{ kN}$

Bearings

203 x 133 x 30 UB stiff bearing length, $b_1 = t + 1.6r + 2T = 37.8 \text{ mm}$
Factor reactions by 1.55 (user selected value)
Local design strength of masonry (factored) = 0.700 N/mm^2 (User-entered value)

R1: 300 x 100 mm padstone

Factored reaction = $13.02 \times 1.55 = 20.18 \text{ kN}$
Factored stress under padstone = $1.55 \times 13.02 \times 1000/300 \times 100 = 0.67 \text{ N/mm}^2$

R2: 950 x 100 mm padstone

Factored reaction = $42.06 \times 1.55 = 65.20 \text{ kN}$
Factored stress under padstone = $1.55 \times 42.06 \times 1000/950 \times 100 = 0.69 \text{ N/mm}^2$

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Beam: Beam 5

Span: 3.6 m.

	Load name	Loading w1	Start x1	Loading w2	End x2	R1comp	R2comp
U T	o.w.	0.3	0		L	0.54	0.54
U T	Roof Load	10.0	0		L	18.00	18.00
U T	Floor Load	5.0	0		L	9.00	9.00
						27.54	27.54

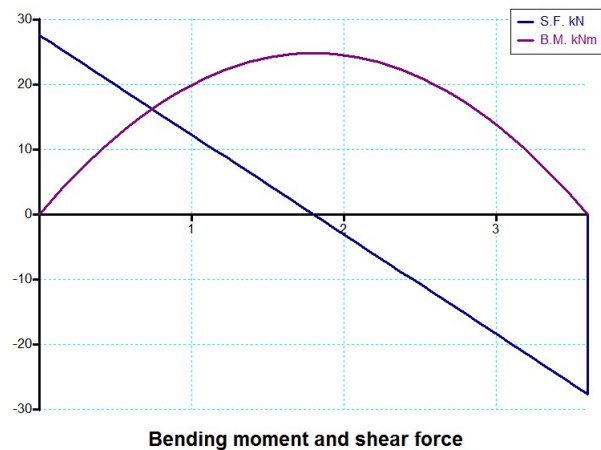
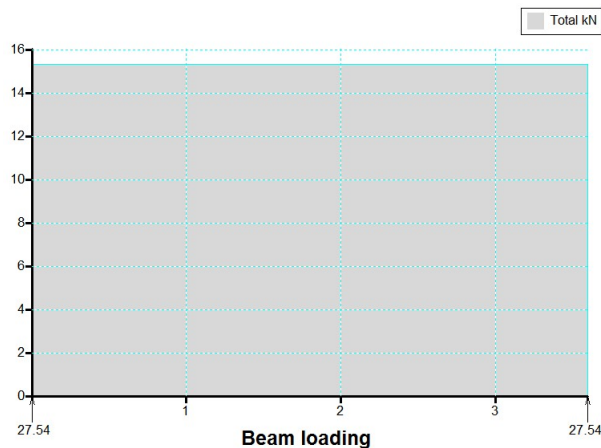
Total load: 55.08 kN

Load types: U: UDL T: Total (positions in m. from R1)

Maximum B.M. = 24.79 kNm at 1.80 m. from R1

Maximum S.F. = 27.54 kN at 0.00 m. from R1

Total deflection = $33.5 \times 10^8 / EI$ at 1.80 m. from R1 (E in N/mm^2 , I in cm^4)



Steel beam calculation to BS449 Part 2 using S355 (Grade 50) steel

SECTION SIZE : 203 x 133 x 30 UB S355 (Grade 50)

$D=206.8$ mm $B=133.9$ mm $t=6.4$ mm $T=9.6$ mm $I_x=2,900$ cm⁴ $r_y=3.17$ cm $Z_x=280$ cm³

Bending: $L_E/r_y = 3.60 \times 100/3.17 = 114$ $D/T = 21.5$

Permissible bending stress, $p_{bc} = 148.1$ N/mm² (Table 3b)

Actual bending stress, $f_{bc} = 24.79 \times 1000/280.0 = 88.5$ N/mm² OK

Shear: Maximum shear in web, $f_s = 27.54 \times 1000/(6.4 \times 206.8) = 20.8$ N/mm² OK

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Beam web: Check unstiffened web capacity with load of 27.54 kN

Bearing: $p_b = 260 \text{ N/mm}^2$ (Table 9); $C1 = 49.6 \text{ kN}$; $C2 = 1.66 \text{ kN/mm}$

Buckling: $p_c = 187 \text{ N/mm}^2$ (Table 17b); $C1 = 124 \text{ kN}$; $C2 = 1.20 \text{ kN/mm}$

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

Bearing capacity, $P_w = C1 + L_b.C2 = 49.6 \text{ kN} \lll$

Buckling capacity, $P_x = C1 + L_b.C2 = 124 \text{ kN}$

Total deflection = $33.5 \times 1e8 / (205,000 \times 2,900) = 5.6 \text{ mm (L/640) OK}$

Combined bending and shear check (14.c): $(f_{bc}/p_{bc})^2 + (f_s/p_s)^2 = 0.357$ at 1.80 m. (≤ 1.25 OK)

Bearings

203 x 133 x 30 UB stiff bearing length, $b_1 = t + 1.6r + 2T = 37.8 \text{ mm}$

Factor reactions by 1.55 (user selected value)

Local design strength of masonry (factored) = 0.700 N/mm^2 (User-entered value)

R1: 650 x 100 mm padstone

Factored reaction = $27.54 \times 1.55 = 42.69 \text{ kN}$

Factored stress under padstone = $1.55 \times 27.54 \times 1000 / 650 \times 100 = 0.66 \text{ N/mm}^2$

R2 as R1

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Beam: Beam 6

Span: 1.74 m.
+ RH Cantilever: 1.86 m.

	Load name	Loading w1	Start x1	Loading w2	End x2	R1comp	R2comp
R T	o.w.	0.3	0		3.6	-0.04	1.12
R T	Roof Load	10.0	0		3.6	-1.24	37.24
R T	Floor Load	5.0	0		3.6	-0.62	18.62
						-1.90	56.98

Total load: 55.08 kN

Load types: R: Part UDL T: Total (positions in m. from R1)

Maximum B.M. (span) = -26.47 kNm at R2

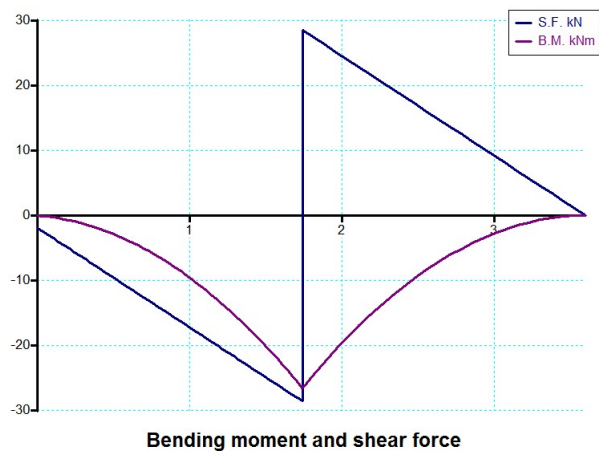
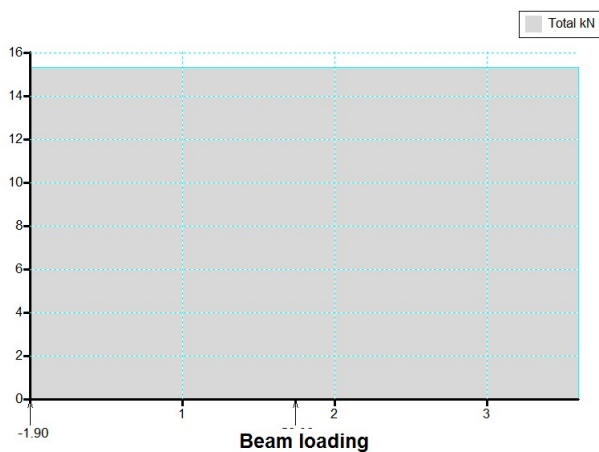
(RH cantilever) = -26.47 kNm

Maximum S.F. (span) = -28.52 kN at R2

(RH cantilever) = 28.46 kN at R2

Maximum deflection (span) = $-3.40 \times 10^8 / EI$ at 1.07 m. from R1

(RH cantilever) = $45.20 \times 10^8 / EI$ (E in N/mm^2 , I in cm^4)



Steel beam calculation to BS449 Part 2 using S355 (Grade 50) steel

SECTION SIZE : 203 x 133 x 30 UB S355 (Grade 50)

D=206.8 mm B=133.9 mm t=6.4 mm T=9.6 mm $I_x=2,900 \text{ cm}^4$ $r_y=3.17 \text{ cm}$ $Z_x=280 \text{ cm}^3$

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Span:

Bending: $L_E/r_y = 1.74 \times 100/3.17 = 55$ $D/T = 21.5$
Permissible bending stress, $p_{bc} = 230 \text{ N/mm}^2$ (Table 4b)
Actual bending stress, $f_{bc} = 26.47 \times 1000/280.0 = 94.5 \text{ N/mm}^2$ OK
Shear: Maximum shear in web, $f_s = 28.52 \times 1000/(6.4 \times 206.8) = 21.5 \text{ N/mm}^2$ OK
Deflection: Total deflection = $-3.40 \times 1e8/(205,000 \times 2,900) = -0.6 \text{ mm}$ OK

RH cantilever:

Bending: $L_e = 2.5L = 4.65\text{m}$. $L_E/r_y = 4.65 \times 100/3.17 = 147$ $D/T = 21.5$
Permissible bending stress, $p_{bc} = 144.1 \text{ N/mm}^2$ (Table 4b)
Actual bending stress, $f_{bc} = 26.47 \times 1000/280.0 = 94.5 \text{ N/mm}^2$ OK
Shear: Maximum shear in web, $f_s = 28.46 \times 1000/(6.4 \times 206.8) = 21.5 \text{ N/mm}^2$ OK
Deflection: Total deflection = $45.2 \times 1e8/(205,000 \times 2,900) = 7.6 \text{ mm}$ ($L/245$) OK

Beam web:

Check unstiffened web capacities with loads of 1.899 kN and 56.98 kN
Bearing: $p_b = 260 \text{ N/mm}^2$ (Table 9); $C1 = 49.6/99.1 \text{ kN}$; $C2 = 1.66 \text{ kN/mm}$
Buckling: $p_c = 187 \text{ N/mm}^2$ (Table 17b); $C1 = 124/248 \text{ kN}$; $C2 = 1.20 \text{ kN/mm}$
R1: Minimum required stiff bearing length, $L_b = 0 \text{ mm}$
Bearing capacity, $P_w = C1 + L_b.C2 = 49.6 \text{ kN} <<<$
Buckling capacity, $P_x = C1 + L_b.C2 = 124 \text{ kN}$
R2: Minimum required stiff bearing length, $L_b = 0 \text{ mm}$
Bearing capacity, $P_w = C1 + L_b.C2 = 99.1 \text{ kN} <<<$
Buckling capacity, $P_x = C1 + L_b.C2 = 248 \text{ kN}$

Bearings

203 x 133 x 30 UB stiff bearing length, $b_1 = t + 1.6r + 2T = 37.8 \text{ mm}$
Factor reactions by 1.55 (user selected value)
Local design strength of masonry (factored) = 0.700 N/mm^2 (User-entered value)

R1: 300 x 100 mm padstone

Factored reaction = $-1.90 \times 1.55 = -2.94 \text{ kN}$
Factored stress under padstone = $1.55 \times -1.90 \times 1000/300 \times 100 = -0.10 \text{ N/mm}^2$

R2: 1300 x 100 mm padstone

Factored reaction = $56.98 \times 1.55 = 88.32 \text{ kN}$
Factored stress under padstone = $1.55 \times 56.98 \times 1000/1300 \times 100 = 0.68 \text{ N/mm}^2$