
MALCOLM SALES

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Tel: 01538 757233. Mob: 07889 225437. E-mail: Malcolm.Sales@salesqs.co.uk

Site: 43, Forest Road, Cuddington, Northwich. CW8 2ED

Job: Alterations to dwelling

Job number: 1705/01

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SuperBeam 7.04a 440085

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SuperBeam Project Summary

Project started 5 May 2017 MJS

Site address: 43, Forest Road, Cuddington, Northwich. CW8 2ED

Job: Alterations to dwelling

Client: Lucy & Greg Thompson

Job number: 1705/01

ITEMS:

- 1: Beam: Lounge area opening (Clear span 3.36m)
Span: 3.685 m. Reactions: R1: 62.50 kN R2: 61.73 kN
Use 2No 305 x 102 x 33 UB S355
Bearing R1: 260 x 325 x 140h mm padstone
Bearing R2: 260 x 325 x 140h mm padstone
Sections to be bolted together with 12mm bolts, nuts, washers and tube spacers or suitable alternative connection at maximum 600mm centres.
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- 2: Beam: To support chimney breast in Lounge (Clear Span 3.48m)
Span: 3.58 m. Reactions: R1: 11.96 kN R2: 6.91 kN
Use 203 x 102 x 23 UB S355
Bearing R1: Not specified
Bearing R2: 225 x 100 x 65h mm padstone
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- 3: Beam: Over window opening (Clear span 1.25)
Span: 1.35 m. Reactions: R1: 7.47 kN R2: 12.84 kN
Use 152 x 89 x 16 UB S355
Bearing R1: 225 x 100 x 65h mm padstone
Bearing R2: 225 x 100 x 65h mm padstone
-

- 4: Beam: Over opening Breakfast/Kitchen (Clear span 1.30m)
Span: 1.4 m. Reactions: R1: 9.71 kN R2: 9.71 kN
Use 2No 152 x 89 x 16 UB S355
Bearing R1: 250 x 100 x 65h mm padstone
Bearing R2: As R1

Sections to be bolted together with 12mm bolts, nuts, washers and tube spacers or suitable alternative connection at maximum 600mm centres.

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Beam: Lounge area opening (Clear span 3.36m)

Span: 3.685 m.

	Load name	Loading w1	Start x1	Loading w2	End x2	R1comp	R2comp
U D	o.w.	0.65	0		L	1.20	1.20
U D	Casing	0.65*0.31	0		L	0.37	0.37
U D	Floors	3.92*0.46	0		L	3.32	3.32
U L	Floors	3.92*1.50	0		L	10.83	10.83
U D	Wall	4.10*4.75	0		L	35.88	35.88
R D	Chimney	1.50*4.32	0		0.86	4.92	0.65
P D	Roof	4.15*2.66*0.75	2.26			3.20	5.08
P L	Roof	4.15*2.30*0.75	2.26			2.77	4.39
Total load: 124.23 kN						62.50	61.73
Dead:						48.90	46.50
Live:						13.60	15.22

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

Maximum B.M. = 60.2 kNm at 2.03 m. from R1

Maximum S.F. = 62.5 kN at 0.00 m. from R1

Live load deflection = $21.1 \times 10^8 / EI$ at 1.87 m. from R1 (E in N/mm^2 , I in cm^4)

Total deflection = $84.2 \times 10^8 / EI$ at 1.87 m. from R1

Steel beam calculation to BS449 Part 2 using S355 steel

SECTION SIZE : 2No 305 x 102 x 33 UB S355

D=312.7 mm B=102.4 mm t=6.6 mm T=10.8 mm $I_x=6,500 \text{ cm}^4$ $r_y=2.15 \text{ cm}$ $Z_x=416 \text{ cm}^3$ (per section)

Bending: $L_E/r_y = 3.68 \times 100/2.15 = 171$ D/T = 29.0

Permissible bending stress, $p_{bc} = 87 \text{ N/mm}^2$ (Table 3b)

Actual bending stress, $f_{bc} = 60.2 \times 1000 / (2 \times 416.0) = 72.4 \text{ N/mm}^2$ OK

Shear: Maximum shear in web, $f_s = 62.5 \times 1000 / (2 \times 6.6 \times 312.7) = 15.1 \text{ N/mm}^2$ OK

Beam web: Check unstiffened web capacities with loads of $62.50/2 = 31.25 \text{ kN}$ and $61.73/2 = 30.86 \text{ kN}$

Bearing: $p_b = 260 \text{ N/mm}^2$ (Table 9); $C1 = 54.7 \text{ kN}$; $C2 = 1.72 \text{ kN/mm}$

Buckling: $p_c = 145 \text{ N/mm}^2$ (Table 17b); $C1 = 150 \text{ kN}$; $C2 = 0.958 \text{ kN/mm}$

R1: Minimum required stiff bearing length, $L_b = 0 \text{ mm}$

Bearing capacity, $P_w = C1 + L_b.C2 = 54.7 \text{ kN} < < <$

Buckling capacity, $P_x = C1 + L_b.C2 = 150 \text{ kN}$

R2: Minimum required stiff bearing length, $L_b = 0 \text{ mm}$

Bearing capacity, $P_w = C1 + L_b.C2 = 54.7 \text{ kN} < < <$

Buckling capacity, $P_x = C1 + L_b.C2 = 150 \text{ kN}$

Deflection: Live load deflection = $21.1 \times 1e8 / (2 \times 205,000 \times 6,500) = 0.8 \text{ mm}$ (L/4663) OK

Total deflection = $84.2 \times 1e8 / (2 \times 205,000 \times 6,500) = 3.2 \text{ mm}$ (L/1167)

Combined bending and shear check (14.c): $(f_{bc}/p_{bc})^2 + (f_s/p_s)^2 = 0.693$ at 2.06 m. (≤ 1.25 OK)

Bearings

305 x 102 x 33 UB stiff bearing length, $b_1 = t + 1.6r + 2T = 40.4 \text{ mm}$; O/A b_1 taken as 142.8 mm

Local design strength of masonry (factored) = 1.14 N/mm^2 (User-entered value)

R1: 260 x 325 x 140h mm padstone

Factored reaction = $48.90 \times 1.4 + 13.60 \times 1.6 = 90.22 \text{ kN}$

Factored stress under padstone = $90.22 \times 1000 / (260 \times 325) = 1.07 \text{ N/mm}^2$

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R2: 260 x 325 x 140h mm padstone

Factored reaction = $46.50 \times 1.4 + 15.22 \times 1.6 = 89.46 \text{ kN}$

Factored stress under padstone = $89.46 \times 1000 / 260 \times 325 = 1.06 \text{ N/mm}^2$

Sections to be bolted together with 12mm bolts, nuts, washers and tube spacers or suitable alternative connection at maximum 600mm centres.

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Beam: To support chimney breast in Lounge (Clear Span 3.48m)

Span: 3.58 m.

Load name	Loading w1	Start x1	Loading w2	End x2	R1comp	R2comp
U D o.w.	0.23	0		L	0.41	0.41
U D Casing	0.45*0.31	0		L	0.25	0.25
R D Chimney breast	6.25*4.32	0.95		1.60	11.30	6.25
Total load: 18.87 kN					11.96	6.91
Dead:					11.96	6.91
Live:					0.00	0.00

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

Maximum B.M. = 13.66 kNm at 1.37 m. from R1

Maximum S.F. = 11.96 kN at 0.00 m. from R1

Live load deflection = $0.00 \times 10^8 / EI$ at R2 (E in N/mm^2 , I in cm^4)

Total deflection = $15.6 \times 10^8 / EI$ at 1.67 m. from R1

Steel beam calculation to BS449 Part 2 using S355 steel

SECTION SIZE : 203 x 102 x 23 UB S355

D=203.2 mm B=101.8 mm t=5.4 mm T=9.3 mm $I_x=2,110 \text{ cm}^4$ $r_y=2.36 \text{ cm}$ $Z_x=207 \text{ cm}^3$

Bending: $L_E/r_y = 3.58 \times 100/2.36 = 152$ D/T = 21.8

Permissible bending stress, $p_{bc} = 111.4 \text{ N/mm}^2$ (Table 3b)

Actual bending stress, $f_{bc} = 13.7 \times 1000/207.0 = 66.0 \text{ N/mm}^2$ OK

Shear: Maximum shear in web, $f_s = 12.0 \times 1000/(5.4 \times 203.2) = 10.9 \text{ N/mm}^2$ OK

Beam web: Check unstiffened web capacities with loads of 11.96 kN and 6.912 kN

Bearing: $p_b = 260 \text{ N/mm}^2$ (Table 9); C1 = 41.1 kN; C2 = 1.40 kN/mm

Buckling: $p_c = 178 \text{ N/mm}^2$ (Table 17b); C1 = 97.8 kN; C2 = 0.963 kN/mm

R1: Minimum required stiff bearing length, $L_b = 0 \text{ mm}$

Bearing capacity, $P_w = C1 + L_b.C2 = 41.1 \text{ kN} <<<$

Buckling capacity, $P_x = C1 + L_b.C2 = 97.8 \text{ kN}$

R2: Minimum required stiff bearing length, $L_b = 0 \text{ mm}$

Bearing capacity, $P_w = C1 + L_b.C2 = 41.1 \text{ kN} <<<$

Buckling capacity, $P_x = C1 + L_b.C2 = 97.8 \text{ kN}$

Deflection: Live load deflection = $0.00 \times 1e8/(205,000 \times 2,110) = 0.0 \text{ mm}$ OK

Total deflection = $15.6 \times 1e8/(205,000 \times 2,110) = 3.6 \text{ mm}$ (L/994)

Combined bending and shear check (14.c): $(f_{bc}/p_{bc})^2 + (f_s/p_s)^2 = 0.350$ at 1.36 m. (≤ 1.25 OK)

Bearings

203 x 102 x 23 UB stiff bearing length, $b_1 = t + 1.6r + 2T = 36.2 \text{ mm}$

R1: None

R2: 225 x 100 x 65h mm padstone

Factored reaction = $6.91 \times 1.4 + 0.00 \times 1.6 = 9.68 \text{ kN}$

Masonry: 10 N/mm^2 brick, class (i) mortar, normal const/normal mfr

Local design strength (factored) = $4/3.5 = 1.14 \text{ N/mm}^2$ (BS5628-1:2005 Table 2a)

Factored stress under padstone = $9.68 \times 1000/225 \times 100 = 0.43 \text{ N/mm}^2$

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Beam: Over window opening (Clear span 1.25)

Span: 1.35 m.

Load name	Loading w1	Start x1	Loading w2	End x2	R1comp	R2comp
U D o.w.	0.16	0		L	0.11	0.11
U D Casing	0.30*0.31	0		L	0.06	0.06
U D Wall	2.95*2.37	0		L	4.72	4.72
U D Roof	0.58*0.75	0		L	0.29	0.29
U L Roof	0.50*0.75	0		L	0.25	0.25
U D Ceiling	1.70*0.35	0		L	0.40	0.40
U L Ceiling	1.70*0.75	0		L	0.86	0.86
P D Beam: To support : R2	6.91 [B/F]	1.20			0.77	6.14
P L Beam: To support : R2	0.00 [B/F]	1.20			0.00	0.00
Total load: 20.31 kN					7.47	12.84
Dead:					6.35	11.73
Live:					1.11	1.11

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

Maximum B.M. = 2.81 kNm at 0.75 m. from R1

Maximum S.F. = -12.84 kN at R2

Live load deflection = $0.071 \times 10^8 / EI$ at 0.68 m. from R1 (E in N/mm^2 , I in cm^4)

Total deflection = $0.546 \times 10^8 / EI$ at 0.70 m. from R1

Steel beam calculation to BS449 Part 2 using S355 steel

SECTION SIZE : 152 x 89 x 16 UB S355

D=152.4 mm B=88.7 mm t=4.5 mm T=7.7 mm $I_x=834 \text{ cm}^4$ $r_y=2.10 \text{ cm}$ $Z_x=109 \text{ cm}^3$

Bending: $L_E/r_y = 1.35 \times 100/2.10 = 64$ D/T = 19.8

Permissible bending stress, $p_{bc} = 211.4 \text{ N/mm}^2$ (Table 3b)

Actual bending stress, $f_{bc} = 2.81 \times 1000/109.0 = 25.8 \text{ N/mm}^2$ OK

Shear: Maximum shear in web, $f_s = 12.8 \times 1000/(4.5 \times 152.4) = 18.7 \text{ N/mm}^2$ OK

Beam web: Check unstiffened web capacities with loads of 7.467 kN and 12.84 kN

Bearing: $p_b = 260 \text{ N/mm}^2$ (Table 9); C1 = 31.0 kN; C2 = 1.17 kN/mm

Buckling: $p_c = 187 \text{ N/mm}^2$ (Table 17b); C1 = 64.2 kN; C2 = 0.842 kN/mm

R1: Minimum required stiff bearing length, $L_b = 0 \text{ mm}$

Bearing capacity, $P_w = C1 + L_b.C2 = 31.0 \text{ kN} <<<$

Buckling capacity, $P_x = C1 + L_b.C2 = 64.2 \text{ kN}$

R2: Minimum required stiff bearing length, $L_b = 0 \text{ mm}$

Bearing capacity, $P_w = C1 + L_b.C2 = 31.0 \text{ kN} <<<$

Buckling capacity, $P_x = C1 + L_b.C2 = 64.2 \text{ kN}$

Deflection: Live load deflection = $0.071 \times 1e8/(205,000 \times 834) = 0.0 \text{ mm}$ OK

Total deflection = $0.546 \times 1e8/(205,000 \times 834) = 0.3 \text{ mm}$ (L/4228)

Combined bending and shear check (14.c): $(f_{bc}/p_{bc})^2 + (f_s/p_s)^2 = 0.019$ at 1.22 m. (≤ 1.25 OK)

Bearings

152 x 89 x 16 UB stiff bearing length, $b_1 = t + 1.6r + 2T = 32.1 \text{ mm}$

Masonry: 10 N/mm^2 brick, class (i) mortar, normal const/normal mfr

Local design strength (factored) = $4/3.5 = 1.14 \text{ N/mm}^2$ (BS5628-1:2005 Table 2a)

R1: 225 x 100 x 65h mm padstone

Factored reaction = $6.35 \times 1.4 + 1.11 \times 1.6 = 10.68 \text{ kN}$

Factored stress under padstone = $10.68 \times 1000/225 \times 100 = 0.47 \text{ N/mm}^2$

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R2: 225 x 100 x 65h mm padstone

Factored reaction = $11.73 \times 1.4 + 1.11 \times 1.6 = 18.20 \text{ kN}$

Factored stress under padstone = $18.20 \times 1000 / 225 \times 100 = 0.81 \text{ N/mm}^2$

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Beam: Over opening Breakfast/Kitchen (Clear span 1.30m)

Span: 1.4 m.

	Load name	Loading w1	Start x1	Loading w2	End x2	R1comp	R2comp
U D	o.w.	0.31	0		L	0.22	0.22
U D	Casing	0.65*0.31	0		L	0.14	0.14
U D	Flat roof	1.15*0.75	0		L	0.60	0.60
U L	Flat roof	1.15*0.75	0		L	0.60	0.60
U D	Wall	2.85*4.08	0		L	8.14	8.14
Total load: 19.41 kN						<u>9.71</u>	<u>9.71</u>
Dead:						9.10	9.10
Live:						0.60	0.60

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

Maximum B.M. = 3.40 kNm at 0.70 m. from R1

Maximum S.F. = 9.71 kN at 0.00 m. from R1

Live load deflection = $0.043 \times 10^8 / EI$ at 0.70 m. from R1 (E in N/mm^2 , I in cm^4)

Total deflection = $0.693 \times 10^8 / EI$ at 0.70 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 $I_x=834 \text{ cm}^4$ $r_y=2.10 \text{ cm}$ $Z_x=109 \text{ cm}^3$ (per section)

Bending: $L_E/r_y = 1.40 \times 100/2.10 = 67$ D/T = 19.8

Permissible bending stress, $p_{bc} = 208 \text{ N/mm}^2$ (Table 3b)

Actual bending stress, $f_{bc} = 3.40 \times 1000/(2 \times 109.0) = 15.6 \text{ N/mm}^2$ OK

Shear: Maximum shear in web, $f_s = 9.71 \times 1000/(2 \times 4.5 \times 152.4) = 7.1 \text{ N/mm}^2$ OK

Beam web: Check unstiffened web capacity with load of $9.705/2 = 4.853 \text{ kN}$

Bearing: $p_b = 260 \text{ N/mm}^2$ (Table 9); C1 = 31.0 kN; C2 = 1.17 kN/mm

Buckling: $p_c = 187 \text{ N/mm}^2$ (Table 17b); C1 = 64.2 kN; C2 = 0.842 kN/mm

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

Bearing capacity, $P_w = C1 + L_b.C2 = 31.0 \text{ kN} <<<$

Buckling capacity, $P_x = C1 + L_b.C2 = 64.2 \text{ kN}$

Deflection: Live load deflection = $0.043 \times 1e8/(2 \times 205,000 \times 834) = 0.0 \text{ mm}$ OK

Total deflection = $0.693 \times 1e8/(2 \times 205,000 \times 834) = 0.2 \text{ mm}$ (L/6904)

Combined bending and shear check (14.c): $(f_{bc}/p_{bc})^2 + (f_s/p_s)^2 = 0.006$ at 0.70 m. (≤ 1.25 OK)

Bearings

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

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

R1: 250 x 100 x 65h mm padstone

Factored reaction = $9.10 \times 1.4 + 0.60 \times 1.6 = 13.71 \text{ kN}$

Factored stress under padstone = $13.71 \times 1000/250 \times 100 = 0.55 \text{ N/mm}^2$

R2 as R1

Sections to be bolted together with 12mm bolts, nuts, washers and tube spacers or suitable alternative connection at maximum 600mm centres.