
Thorns young architectural ltd
232 London Road, North End, Portsmouth. 02392 672883

Site: 12 Mitchell Road, Havant

Job: Rear Extension

Job number: 9142.16.RN

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SuperBeam 4 UK Project Summary

Project started 12 Jul 2016 RN

Site address: 12 Mitchell Road, Havant

Job: Rear Extension

Client: Ms C Scott

Job number: 9142.16.RN

ITEMS:

- 1: Beam: Existing steel
 Span: 2.9 m. Reactions: R1: 10.14 kN R2: 10.14 kN
 Use 152 x 89 x 16 UKB S275
 Bearing R1: Not specified
 Bearing R2: 225 x 100 mm padstone

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- 2: Beam: Steel S1
 Span: 3.75 m. Reactions: R1: 39.91 kN R2: 43.82 kN
 Use 254 x 146 x 37 UKB S275
 Encase beam to provide half-hour fire resistance as per specification
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Beam: Existing steel

Span: 2.9 m.

	Load name	Loading w1	Start x1	Loading w2	End x2	R1comp	R2comp
U T	o.w.	0.2	0		L	0.29	0.29
U T	blockwork	2.30mx 2.50	0		L	8.34	8.34
U T	floor	0.40mx 1.90	0		L	1.10	1.10
U T	ceiling	0.40mx 0.70	0		L	0.41	0.41
						10.14	10.14

Total load: 20.27 kN

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

Maximum B.M. = 7.35 kNm at 1.45 m. from R1

Maximum S.F. = 10.14 kN at 0.00 m. from R1

Total deflection = $6.44 \times 10^8 / EI$ at 1.45 m. from R1 (E in N/mm^2 , I in cm^4)

Steel calculation to BS449 Part 2 using S275 steel

SECTION SIZE : 152 x 89 x 16 UKB S275

$D=152.4$ 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

Bending: $L_e = 1.2L = 3.48$ m. $L_e/r_y = 3.48 \times 100/2.10 = 166$ $D/T = 19.8$

Permissible bending stress, $p_{bc} = 94.3$ N/mm² (Table 3a)

Actual bending stress, $f_{bc} = 7.35 \times 1000/109.0 = 67.4$ N/mm² OK

Shear: Maximum shear in web, $f_s = 10.1 \times 1000/(4.5 \times 152.4) = 14.8$ N/mm² OK

Beam web: Check unstiffened web capacity with load of 10.14 kN

Bearing: $p_b = 210$ N/mm² (Table 9); $C1 = 25.0$ kN; $C2 = 0.945$ kN/mm

Buckling: $p_c = 146$ N/mm² (Table 17a); $C1 = 50.1$ kN; $C2 = 0.657$ kN/mm

Unstiffened web bearing capacity, $P_w = 25.0$ kN: no minimum stiff bearing length required

Total deflection = $6.44 \times 1e8/(205,000 \times 834) = 3.8$ mm (L/770) OK

Combined bending and shear check (14.c): $(f_{bc}/p_{bc})^2 + (f_s/p_s)^2 = 0.511$ at 1.45 m. (≤ 1.25 OK)

Bearings

152 x 89 x 16 UKB stiff bearing length, $b_1 = t + 1.6r + 2T = 32.1$ mm

Factor reactions by 1.55 (user selected value)

R1: None

R2: 225 x 100 mm padstone

Factored reaction = $10.14 \times 1.55 = 15.71$ kN

Local design strength of masonry (factored) = 0.700 N/mm² (User-entered value)

Factored stress under padstone = $1.55 \times 10.14 \times 1000/225 \times 100 = 0.70$ N/mm²

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Beam: Steel S1

Span: 3.75 m.

Load name	Loading w1	Start x1	Loading w2	End x2	R1comp	R2comp
U T o.w.	0.75	0		L	1.41	1.41
U T cavity wall	2.50mx 4.80	0		L	22.50	22.50
U T ceiling	1.50mx 0.70	0		L	1.97	1.97
U T floor	1.50m x 1.90	0		L	5.34	5.34
U T main roof	1.70mx 1.75	0		L	5.58	5.58
P T Bm: Existing steel : R1	10.14 [B/F]	2.60			3.11	7.03
					39.91	43.82

Total load: 83.73 kN

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

Maximum B.M. = 40.57 kNm at 2.03 m. from R1

Maximum S.F. = -43.82 kN at R2

Total deflection = $59.5 \times 10^8 / EI$ at 1.91 m. from R1 (E in N/mm^2 , I in cm^4)

Steel calculation to BS449 Part 2 using S275 steel

SECTION SIZE : 254 x 146 x 37 UKB S275

D=256.0 mm B=146.4 mm t=6.3 mm T=10.9 mm $I_x=5,540 \text{ cm}^4$ $r_y=3.48 \text{ cm}$ $Z_x=433 \text{ cm}^3$

Bending: $L_e = 1.2L = 4.50\text{m}$. $L_e/r_y = 4.50 \times 100/3.48 = 129$ D/T = 23.5

Permissible bending stress, $p_{bc} = 107.3 \text{ N/mm}^2$ (Table 3a)

Actual bending stress, $f_{bc} = 40.6 \times 1000/433.0 = 93.7 \text{ N/mm}^2$ OK

Shear: Maximum shear in web, $f_s = 43.8 \times 1000/(6.3 \times 256.0) = 27.2 \text{ N/mm}^2$ OK

Beam web: Check unstiffened web capacities with loads of 39.91 kN and 43.82 kN

Stiffeners are required where reactions are taken on bottom flange and minimum stiff bearing length(s) shown below cannot be provided

Bearing: $p_b = 210 \text{ N/mm}^2$ (Table 9); C1 = 42.4 kN; C2 = 1.32 kN/mm

Buckling: $p_c = 135 \text{ N/mm}^2$ (Table 17a); C1 = 109 kN; C2 = 0.849 kN/mm

R1: Unstiffened web bearing capacity, $P_w = 42.4 \text{ kN}$: no minimum stiff bearing length required

R2: Minimum required stiff bearing length, $L_b = 2 \text{ mm}$

Bearing capacity, $P_w = 42.4 + 2 \times 1.32 = 45.0 \text{ kN}$

With $L_b = 2 \text{ mm}$, buckling capacity, $P_x = 109 + 2 \times 0.849 = 110 \text{ kN}$

Total deflection = $59.5 \times 1e8/(205,000 \times 5,540) = 5.2 \text{ mm}$ (L/716) OK

Combined bending and shear check (14.c): $(f_{bc}/p_{bc})^2 + (f_s/p_s)^2 = 0.763$ at 2.02 m. (≤ 1.25 OK)

Encase beam to provide half-hour fire resistance as per specification