Calculation	Project		Job Ref.	
Brian Hobson Associates 220 Bramhall Lane South Bramhall Cheshire SK7 3AA	**Extension at Manchester Road/Wilbraham Road**		**C8181**	
	Section **Steelwork Calculations**		Sheet No./Rev. 1	
	Calc. by **BGH**	Date **10/06/13**	Checked by **BGH**	Date **10/06/13**

Extension at Manchester Road/Wilbraham Road

Code References:

BS5950 Part 1: 2000	Structural use of Steelwork in Building
BS6399 Part 1: 1996	Loadings for Buildings: Design Loads
BS6399 Part 1: 1997	Loadings for Buildings: Imposed Roof Loads

Drawing/Input References: 3no. architect's plans and elevations

Designed/Checked by:

B. G. Hobson CEng FICE FIStructE..... B Hobson .....

Date:..... 10 - 06 - 13 .....

Calculation	Project		Job Ref.	
	Extension at Manchester Road/Wilbraham Road		**C8181**	
Brian Hobson Associates 220 Bramhall Lane South Bramhall Cheshire SK7 3AA	Section **Steelwork Calculations**		Sheet No./Rev. 2	
	Calc. by **BGH**	Date **10/06/13**	Checked by **BGH**	Date **10/06/13**

1.0 Loading Data

(a) Existing/New Roof:

Imposed load = 0.6 kN/m²

Dead load = 1.25 kN/m²

(b) Existing First Floor (assume office loading):

Imposed load = 2.5 kN/m²

Dead load (timber) = 0.5 kN/m²

(c) Existing Outer Wall (assume cavity brickwork):

Outer leaf = 2.25 kN/m²

Inner leaf (plastered) = 2.75 kN/m²

(d) New Cavity Wall:

Outer leaf = 2.25 kN/m²

Inner leaf (blockwork) = 1.5 kN/m²

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2. Beams 1 (RSJ 1 on plan), span = 3.7m

(a) Beam to inner leaf:

UDL from ex. roof (rafter/purlin roof):

LL = 0.6 x 2.5/2 x 1.6 = 1.2 kN/m (factored)

DL = 1.25 x 2.5/2 x 1.6 = 2.19 kN/m (factored)

UDL from ex. first floor:

LL = 2.5 x 3.0/2 x 1.6 = 6.0 kN/m (factored)

DL = 0.5 x 3.0/2 x 1.4 = 1.05 kN/m (factored)

UDL from inner leaf of cavity wall:

DL = 2.75 x 2.5 x 1.4 = 9.63 kN/m (factored)

Total = 20.07 kN/m (factored)

Try 254 x 102 x 28 UB

M_{MAX} = 20.07 x $3.7^2/8$ = 34.34 kNm

From Tables, M_b = 37 kNm > 34.34 ∴ **section adequate in bending**

Check for deflection:

Unfactored load = 20.07/1.45 = 13.84 kN/m

I Req'd = $\frac{13.84 \times 3.7^3}{0.448}$ = 1565 cm^4

< 4005

∴ **section adequate in deflection**

∴ **use 254 x 102 x 28 UB**

(b) Beam to outer leaf:

UDL from new roof (rafter/purlin roof):

LL = 0.6 x 2.7/2 x 1.6 = 1.30 kN/m (factored)

DL = 1.25 x 2.7/2 x 1.4 = 2.36 kN/m (factored)

UDL from new first floor:

LL = 2.5 x 2.7/2 x 1.6 = 5.4 kN/m (factored)

DL = 0.5 x 2.7/2 x 1.4 = 0.95 kN/m (factored)

UDL from outer leaf of cavity wall:

DL = 2.25 x 2.5 x 1.4 = 7.88 kNm (factored)

Total = 17.89 kN/m (factored)

By inspection, use 254 x 102 x 28 UB

Check for Padstones:

Total factored reaction = (20.07 + 17.9) x 3.7/2 = 70.24 kN

Try 275 x 150 x 150 deep conc. padstone

Applied compression = $\frac{70.24 \times 10^3}{275 \times 150}$ = 1.7 N/mm²

acceptable for commons brickwork or similar

∴ **use 275 x 150 x 150 deep concrete padstone each end**

3.0 Beams 2 (RSJ 2 on plan), span 4.52m

(a) Beam to inner leaf:

UDL from new roof (rafter/purlin roof):

LL = 0.6 x 2.7/2 x 1.6 = 1.30 kN/m (factored)

DL = 1.25 x 2.7/2 x 1.4 = 2.36 kN/m (factored)

UDL from new first floor:

LL = 2.5 x 2.7/2 x 1.6 = 5.4 kN/m (factored)

DL = 0.5 x 2.7/2 x 1.4 = 0.95 kN/m (factored)

UDL from inner leaf of new cavity wall (blockwork):

DL = 1.5 x 2.0 x 1.4 = 4.2 kN/m(factored)

Total = 14.21 kN/m (factored)

Try 305 x 102 x 33 UB

M_{MAX} = $14.21 \times 4.52^2/8$ = 36.3 kNm

From Tables, M_b = 37 kNm > 36.2 ∴ **section o.k. in bending**

Check for deflection:

Unfactored load = 14.21/1.45 = 9.8 k/Nm

I req'd = $\frac{9.8 \times 4.52^3}{0.448}$ = 2020 cm^4

< 6501

∴ **section adequate in deflection**

∴ **use 305 x 102 x 33 UB**

(b) Beam to outer leaf:

Assume roof load half previous beam:
(spans in opposite direction)

LL = 0.65 kN/m (factored)

DL = 1.18 kN/m (factored)

UDL from new first floor:

as previous beam:

LL = 5.4 kN/m (factored)

DL = 0.95 kN/m (factored)

UDL from outer leaf of new cavity wall:

DL = 2.25 x 2.0 x 1.4 = 6.3 kN/m (factored)

Total = 14.48 kN/m (factored)

By inspection, use 305 x 102 x 33 UB

Check for Padstones:

Total factored reaction = (14.21 + 14.48) x 4.52/2 = 64.84 kN

Try 350 x 100 x 150 deep conc. padstone

Applied compression = $\frac{64.84 \times 10^3}{350 \times 100}$ = 1.85 N/mm²

< 2.74 for 7N blockwork

∴ **use 350 x 100 x 150 deep conc. padstone each end**