KCRDESIGN
PLANS TO INSPIRE

Structural Calculations
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February 2016

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The span quoted is solely for the purpose of producing these structural calculations. Measurements must be taken on site before ordering any materials.

Beams specified for load bearing walls of cavity construction, are often two beams, one for each skin of brick/blockwork. Check the comments at the bottom of the page for each beam specified, before ordering any materials.

Loading Data

9"BRICKWORK:

215mm Brickwork	=4.80kN/m2
Plaster	=0.60kN/m2
Total Load	**=5.40kN/m2**

BRICKWORK PARTITION:

100mm Brickwork	=2.10kN/m2
2 No. Plaster Faces	=0.60kN/m2
Total Load	**=2.70kN/m2**

BLOCKWORK PARTITION:

100mm Blockwork	=1.00kN/m2
2 No. Plaster Faces	=0.50kN/m2
Total Load	**=1.50kN/m2**

TILE HANGING TO TIMBER FRAME:

Concrete Tiles	=0.55kN/m2
Battens & Felt	=0.10kN/m2
Timber Studs	=0.10kN/m2
Plasterboard	=0.15kN/m2
Insulation	=0.05kN/m2
Plaster	=0.25kN/m2
Total Load	**=1.20kN/m2**

TIMBER STUD PARTITION:

2 No. Plasterboard Faces	=0.30kN/m2
Timber Studs	=0.10kN/m2
2 No. Plaster Faces	=0.30kN/m2
Insulation	=0.05kN/m2
Total Load	**=0.75kN/m2**

PITCHED ROOF:

Concrete Tiles	=0.60kN/m2
Battens & Felt	=0.10kN/m2
Rafters	=0.15kN/m2
Total Dead Load	=0.85kN/m2
Imposed Load	=0.75kN/m2
Total Load	**=1.60kN/m2**

ROOF SPACE:

Joists & Insulation	=0.15kN/m2
Ceiling	=0.15kN/m2
Total Dead Load	=0.30kN/m2
Imposed Load	=0.25kN/m2
Total Load	**=0.55kN/m2**

SLOPING CEILING:

Plasterboard	=0.15kN/m2
Insulation	=0.10kN/m2
Total Dead Load	=0.25kN/m2
Total Load	**=0.45kN/m2**

FLAT ROOF:

Chipping & Felt	=0.35kN/m2
Boards, Joists & Firings	=0.30kN/m2
Ceiling & Insulation	=0.15kN/m2
Total Dead Load	=0.80kN/m2
Imposed Load	=0.75kN/m2
Total Load	**=1.55kN/m2**

TIMBER ROOF:

Boards & Joists	=0.35kN/m2
Ceiling	=0.15kN/m2
Total Dead Load	=0.50kN/m2
Imposed Load	=1.50kN/m2
Total Load	**=2.00kN/m2**

EXTERNAL RENDER WALL:

Render 2 No. Skins	=0.30kN/m2
100mm Blockwork	=2.00kN/m2
Insulation	=0.05kN/m2
Plaster	=0.25kN/m2
Total Load	**=2.60kN/m2**

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Beam: **Beam A** **Span: 3.4 m.**

		Load name	*Loading w1*	*Start x1*	*Loading w2*	*End x2*	*R1comp*	*R2comp*
U	T	o.w.	0.25	0		L	0.43	0.43
U	T	BRICKWORK PARTITION	2.70*2.40	0		L	11.02	11.02
U	T	TIMBER FLOOR	2.00*1.40	0		L	4.76	4.76
U	T	TIMBER FLOOR	2.00*0.70	0		L	2.38	2.38
							18.58	18.58

Total load: 37.16 kN

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

Maximum B.M. = 15.8 kNm at 1.70 m. from R1

Maximum S.F. = 18.6 kN at R1

Total deflection = 19.0 x 10^8/EI at 1.70 m. from R1 *(E in N/mm^2, I in cm^4)*

Steel calculation to BS449 Part 2 using S275 (Grade 43) steel

SECTION SIZE : **203 x 102 x 23 UB Grade 43**

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

L_E/r_y = 3.40x100/2.36 = 144 D/T = 21.8

Permissible bending stress, p_{bc} = 100.8 N/mm^2 (Table 3a)

Actual bending stress, f_{bc} = 15.79 x 1000/207.0 = 76.3 N/mm^2 OK

Maximum shear in web, f_s = 18.58 x 1000/(5.4 x 203.2) = 16.9 N/mm^2 OK

Check unstiffened web capacity with load of 18.58 kN

Bearing: p_h = 210N/mm^2 (Table 9); C1 = 33.2 kN; C2 = 1.13 kN/mm

Buckling: p_c = 140N/mm^2 (Table 17a); C1 = 76.6 kN; C2 = 0.754 kN/mm

Unstiffened web bearing capacity, P_w = 33.2kN: no minimum stiff bearing length required

Total deflection = 19.0 x 1e8/(205,000 x 2,110) = 4.4 mm (L/773) OK

Combined bending and shear check (14.c): $(f_{bc}/p_{bc})^2 + (f_s/p_s)^2$ = 0.573 at 1.70 m. (<=1.25 OK)

Bearing details *(bearing plate sizing to BS5950-1:2000)*

203x102x23 UB stiff bearing length, $b_1 = t + 1.6r + 2T$ = 36.2 mm

Factor reactions by 1.55 (user selected value)

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

R1: 450 x 100 mm bearing plate

Factored reaction = 18.58 x 1.55 = 28.80 kN

20 mm m.s. bearing plate, size 450 x 100 mm
Bearing plate projection beyond stiff bearing length = (450-36.2)/2 = 206.9mm
Factored stress under plate = 1.55 x 18.58 x 1000/450 x 100 = 0.64 N/mm^2
Required plate thickness = $\sqrt{}$(3x0.64x207x207/265) = 17.6 mm: use 20mm
Factored bending stress in plate = 0.64x207x(207/2)/(20x20/6) = 205.5 N/mm^2 (p_y=265 N/mm^2)

R2 as R1

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