

Structural Calculations
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March 2016

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/m ²
Plaster	=0.60kN/m ²
Total Load	=5.40kN/m²

BRICKWORK PARTITION:

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

BLOCKWORK PARTITION:

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

TILE HANGING TO TIMBER FRAME:

Concrete Tiles	=0.55kN/m ²
Battens & Felt	=0.10kN/m ²
Timber Studs	=0.10kN/m ²
Plasterboard	=0.15kN/m ²
Insulation	=0.05kN/m ²
Plaster	=0.25kN/m ²
Total Load	=1.20kN/m²

TIMBER STUD PARTITION:

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

PITCHED ROOF:

Concrete Tiles	=0.60kN/m ²
Battens & Felt	=0.10kN/m ²
Rafters	=0.15kN/m ²
Total Dead Load	=0.85kN/m ²
Imposed Load	=0.75kN/m ²
Total Load	=1.60kN/m²

ROOF SPACE:

Joists & Insulation	=0.15kN/m ²
Ceiling	=0.15kN/m ²
Total Dead Load	=0.30kN/m ²
Imposed Load	=0.25kN/m ²
Total Load	=0.55kN/m²

SLOPING CEILING:

Plasterboard	=0.15kN/m ²
Insulation	=0.10kN/m ²
Total Dead Load	=0.25kN/m ²
Total Load	=0.45kN/m²

FLAT ROOF:

Chipping & Felt	=0.35kN/m ²
Boards, Joists	
& Firings	=0.30kN/m ²
Ceiling &	
Insulation	=0.15kN/m ²
Total Dead Load	=0.80kN/m ²
Imposed Load	=0.75kN/m ²
Total Load	=1.55kN/m²

TIMBER ROOF:

Boards & Joists	=0.35kN/m ²
Ceiling	=0.15kN/m ²
Total Dead Load	=0.50kN/m ²
Imposed Load	=1.50kN/m ²
Total Load	=2.00kN/m²

EXTERNAL RENDER WALL:

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

KCR Design

6 Chada Avenue Gillingham Kent ME7 4BN

KCR Design | www.kcrdesign.co.uk | Phone: 01634 757355 | email: keith.rogers@kcrdesign.co.uk

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Job:

MEASUREMENTS TO BE TAKEN ON SITE BEFORE ORDERING MATERIALS

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SuperBeam 4.57f 452185

Noname.SBW

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Beam: Beam A

Span: 3.3 m.

	Load name	Loading w1	Start x1	Loading w2	End x2	R1comp	R2comp
U T	o.w.	0.4	0		L	0.66	0.66
U T	BRICKWORK PARTITION	2.70*2.40	0		L	10.69	10.69
U T	BRICKWORK PARTITION	2.70*2.40	0		L	10.69	10.69
U T	PITCHED ROOF	1.60*2.00	0		L	5.28	5.28
U T	PITCHED ROOF	1.60*2.00	0		L	5.28	5.28
						32.60	32.60

Total load: 65.21 kN

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

Maximum B.M. = 26.9 kNm at 1.65 m. from R1

Maximum S.F. = 32.6 kN at R1

Total deflection = $30.5 \times 10^8 / EI$ at 1.65 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 : 152 x 152 x 37 UC Grade 43

$D=161.8$ mm $B=154.4$ mm $t=8.0$ mm $T=11.5$ mm $I_x=2,210$ cm⁴ $r_y=3.87$ cm $Z_x=273$ cm³

$L_E/r_y = 3.30 \times 100 / 3.87 = 85$ $D/T = 14.1$

Permissible bending stress, $p_{bc} = 158$ N/mm² (Table 3a)

Actual bending stress, $f_{bc} = 26.90 \times 1000 / 273.0 = 98.5$ N/mm² OK

Maximum shear in web, $f_s = 32.60 \times 1000 / (8.0 \times 161.8) = 25.2$ N/mm² OK

Check unstiffened web capacity with load of 32.60 kN

Bearing: $p_h = 210$ N/mm² (Table 9); $C1 = 55.6$ kN; $C2 = 1.68$ kN/mm

Buckling: $p_c = 156$ N/mm² (Table 17a); $C1 = 101$ kN; $C2 = 1.25$ kN/mm

Unstiffened web bearing capacity, $P_w = 55.6$ kN: no minimum stiff bearing length required

Total deflection = $30.5 \times 10^8 / (205,000 \times 2,210) = 6.7$ mm ($L/490$) OK

Combined bending and shear check (14.c): $(f_{bc}/p_{bc})^2 + (f_s/p_s)^2 = 0.389$ at 1.65 m. (≤ 1.25 OK)

Bearing details

152x152x37 UC stiff bearing length, $b_1 = t + 1.6r + 2T = 43.2$ mm

Factor reactions by 1.55 (user selected value)

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

R1: 750 x 100 x 375h mm padstone

(minimum padstone height if unreinforced: 354 mm)

Factored reaction = $32.60 \times 1.55 = 50.54$ kN

Factored stress under padstone = $1.55 \times 32.60 \times 1000 / 750 \times 100 = 0.67$ N/mm²

R2 as R1

Encase beam to provide half-hour fire resistance as per specification. Use 2No. beams, one for each skin