KCRDESIGN
PLANS TO INSPIRE

Structural Calculations
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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**

Beam: **Beam A** **Span: 3.7 m.**

	Load name	*Loading w1*	*Start x1*	*Loading w2*	*End x2*	*R1comp*	*R2comp*
U T	o.w.	0.1	0		L	0.19	0.19
U T	TIMBER STUD PARTITION	0.75*1.80	0		L	2.50	2.50
						2.68	2.68

Total load: 5.37 kN

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

Maximum B.M. = 2.48 kNm at 1.85 m. from R1

Maximum S.F. = 2.68 kN at R1

Total deflection = 3.54 x 10^8/EI at 1.85 m. from R1 *(E in N/mm^2, I in cm^4)*

Timber beam calculation to BS5268 Part 2: 2002 using C24 timber

Use 75 x 220 C24 *6.9 kg/m approx*

z = 605.0 cm^3 I = 6,655 cm^4

Timber grade: C24 Single member: No load sharing

K_3 (loading duration factor) = 1.00 K_7 (depth factor) = 1.035 K_8 (load sharing factor) = 1.0

E = 7,200 N/mm^2 (E_{min})

Bending

Permissible bending stress, $\sigma_{m,adm} = \sigma_{m,g}.K_3.K_7.K_8$ = 7.5 x 1.00 x 1.035 x 1.0 = 7.76 N/mm^2

Applied bending stress, $\sigma_{m,a}$ = 2.48 x 1000/605.0 = 4.10 N/mm^2 OK

Shear

Permissible shear stress, $\tau_{adm,//} = \tau_{g,//}.K_3.K_8$ = 0.71 x 1.00 x 1.0 = 0.71 N/mm^2

Applied shear stress, τ_a = 2.68 x 1000 x 3/2 x 75 x 220 = 0.24 N/mm^2 OK

Deflection

Bending deflection = 3.54 x 10^8/7,200 x 6,655 = 7.38 mm

Mid-span shear deflection = 1.2 x 2.48 x 10^6/((E/16) x 75 x 220) = 0.40 mm

Total deflection = 7.38 + 0.40 = 7.78 mm (0.0021 L) <=0.003L OK

Beam: **Celing joists** **Span: 4.5 m.**

	Load name	*Loading w1*	*Start x1*	*Loading w2*	*End x2*	*R1comp*	*R2comp*
U T	o.w.	0.1	0		L	0.23	0.23
U T	ROOF SPACE	0.55*0.40	0		L	0.50	0.50
						0.72	0.72

Total load: 1.44 kN

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

Maximum B.M. = 0.810 kNm at 2.25 m. from R1

Maximum S.F. = 0.720 kN at R1

Total deflection = 1.71 x 10^8/EI at 2.25 m. from R1 *(E in N/mm^2, I in cm^4)*

Timber beam calculation to BS5268 Part 2: 2002 using C16 timber

Use 50 x 195 C16 *3.6 kg/m approx*

z = 316.9 cm^3 I = 3,090 cm^4

Timber grade: C16 Single member: No load sharing

K_3 (loading duration factor) = 1.00 K_7 (depth factor) = 1.049 K_8 (load sharing factor) = 1.0

E = 5,800 N/mm^2 (E_{min})

Bending

Permissible bending stress, $\sigma_{m,adm} = \sigma_{m,g}.K_3.K_7.K_8 = 5.3 \times 1.00 \times 1.049 \times 1.0 = 5.56$ N/mm^2

Applied bending stress, $\sigma_{m,a} = 0.810 \times 1000/316.9 = 2.56$ N/mm^2 OK

Shear

Permissible shear stress, $\tau_{adm,//} = \tau_{g,//}.K_3.K_8 = 0.67 \times 1.00 \times 1.0 = 0.67$ N/mm^2

Applied shear stress, $\tau_a = 0.720 \times 1000 \times 3/2 \times 50 \times 195 = 0.11$ N/mm^2 OK

Deflection

Bending deflection = 1.71 x 10^8/5,800 x 3,090 = 9.53 mm

Mid-span shear deflection = 1.2 x 0.810 x 10^6/((E/16) x 50 x 195) = 0.28 mm

Total deflection = 9.53 + 0.28 = 9.81 mm (0.0022 L) <=0.003L OK

Beam: **Rafters** **Span: 4.3 m.**

		Load name	*Loading w1*	*Start x1*	*Loading w2*	*End x2*	*R1comp*	*R2comp*
U	T	o.w.	0.1	0		L	0.22	0.22
U	T	PITCHED ROOF	1.60*0.40	0		L	1.38	1.38
							1.59	1.59

Total load: 3.18 kN

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

Maximum B.M. = 1.71 kNm at 2.15 m. from R1

Maximum S.F. = 1.59 kN at R1

Total deflection = 3.29 x 10^8/EI at 2.15 m. from R1 *(E in N/mm^2, I in cm^4)*

Timber beam calculation to BS5268 Part 2: 2002 using C24 timber

Use 50 x 225 C24 *4.7 kg/m approx*

z = 421.9 cm^3 I = 4,746 cm^4

Timber grade: C24 Single member: No load sharing

K_3 (loading duration factor) = 1.00 K_7 (depth factor) = 1.032 K_8 (load sharing factor) = 1.0

E = 7,200 N/mm^2 (E_{min})

Bending

Permissible bending stress, $\sigma_{m,adm} = \sigma_{m,g}.K_3.K_7.K_8 = 7.5 \times 1.00 \times 1.032 \times 1.0 = 7.74$ N/mm^2

Applied bending stress, $\sigma_{m,a} = 1.71 \times 1000/421.9 = 4.05$ N/mm^2 OK

Shear

Permissible shear stress, $\tau_{adm,//} = \tau_{g,//}.K_3.K_8 = 0.71 \times 1.00 \times 1.0 = 0.71$ N/mm^2

Applied shear stress, $\tau_a = 1.59 \times 1000 \times 3/2 \times 50 \times 225 = 0.21$ N/mm^2 OK

Deflection

Bending deflection = 3.29 x 10^8/7,200 x 4,746 = 9.64 mm

Mid-span shear deflection = 1.2 x 1.71 x 10^6/((E/16) x 50 x 225) = 0.41 mm

Total deflection = 9.64 + 0.41 = 10.04 mm (0.0023 L) <=0.003L OK