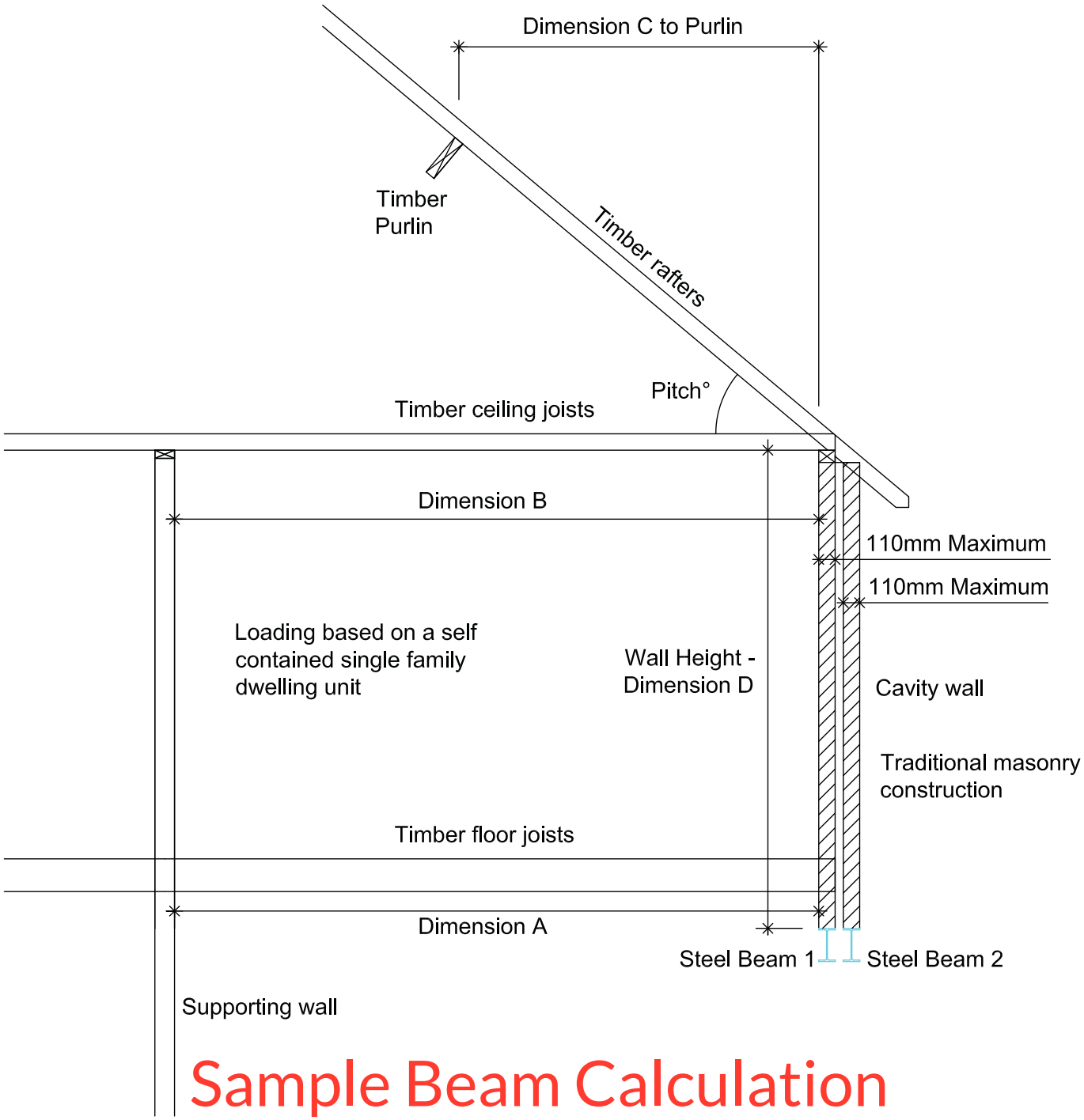
Steel Beam and Padstones Calculation

Sample Beam Calculation
Report from Build Calcs
www.beamcalculation.co.uk

Job number: 185



Floor joists - Dimension A	3500	millimetres
Ceiling joists - Dimension B	3200	millimetres
Non load bearing timber stud partitions on top of joists	Yes	
Dimension to purlin - Dimension C	2600	millimetres
Roof pitch	30	degrees
Wall height - Dimension D	2400	millimetres
Steel beam length	3400	millimetres

Project name:	Job number: 185
Description/Notes: Steel Beam	Date: 29 Nov 2016

Design loads,

Steel Beam 1,

						γf		
Roof Variable	=	0.75kN/m^2 x 1.80m	=	1.35kN/m	x	1.5	=	2.03kN/m

Roof Permanent on Slope,
Tiles
= 0.75kN/m^2
Battens, Felt
= 0.05kN/m^2
Rafters
= 0.10kN/m^2

Σ 0.90kN/m^2

Roof Permanent on Plan = 0.90kN/m^2 / cos 30° = 1.04kN/m^2

Roof Permanent	=	1.04kN/m^2 x 1.80m	=	1.87kN/m	x	1.35	=	2.52kN/m
Ceiling Variable	=	0.25kN/m^2 x 1.60m	=	0.40kN/m	x	1.5	=	0.60kN/m
Ceiling Permanent	=	0.30kN/m^2 x 1.60m	=	0.48kN/m	x	1.35	=	0.65kN/m
Stud Partitions	=	0.25kN/m^2 x 1.75m	=	0.44kN/m	x	1.5	=	0.66kN/m
Floor Variable	=	1.5kN/m^2 x 1.75m	=	2.63kN/m	x	1.5	=	3.95kN/m
Floor Permanent	=	0.6kN/m^2 x 1.75m	=	1.05kN/m	x	1.35	=	1.42kN/m
Inner Leaf Wall	=	2.2kN/m^2 x 2.40m	=	5.28kN/m	x	1.35	=	7.13kN/m
Beam Self Weight			=	0.40kN/m	x	1.35	=	0.54kN/m
			Σ	**13.90kN/m**			**Σ**	**19.50kN/m**

Steel Beam 2,

						γf		
Outer Leaf Wall	=	2.3kN/m^2 x 2.40m	=	5.52kN/m	x	1.35	=	7.45kN/m
Beam Self Weight			=	0.40kN/m	x	1.35	=	0.54kN/m
			Σ	**5.92kN/m**			**Σ**	**7.99kN/m**

Steel Beam 1 Design,

Bending Moment = 19.5kN/m x (3.4m)^2/8 = 28.18kNm

Check Variable Load Deflection, span/360,

Iyy Required = 2.232 x 4.82kN/m x (3.4m)^3 = 422.84cm^4

Check Total Load Deflection, span/250,

Iyy Required = 1.55 x 13.9kN/m x $(3.4m)^3$ = 846.8cm^4

Use 203x133x25 UB S355 Steel Beam 1

l = 3.4m le = 1.4l + 2h = 6m

C1 = 1.13

Mb = 37.4kNm > 28.18kNm

Iyy = 2340cm^4 > 422.84cm^4

Iyy = 2340cm^4 > 846.8cm^4

Padstones to Beam 1,

Reaction = 19.5kN/m x 3.4m/2 = 33.15kN

Allowable Bearing Stress = 1.0N/mm^2

Use Dense Concrete Padstone 440mm Long x 100mm Wide x 215mm Deep for Beam 1

Padstones to have a minimum compressive strength of 40N/mm^2

Steel Beam to have a minimum end bearing length of 100mm

1.0N/mm^2 x 440mm x 100mm/10^3 = 44.0kN > 33.15kN

Steel Beam 2 Design,

Bending Moment = 7.99kN/m x $(3.4m)^2$/8 = 11.55kNm

Check Total Load Deflection, span/250,

Iyy Required = 1.55 x 5.92kN/m x $(3.4m)^3$ = 360.65cm^4

Use 203x133x25 UB S355 Steel Beam 2

l = 3.4m le = 1.4l + 2h = 6m

C1 = 1.13

Mb = 37.4kNm > 11.55kNm

Iyy = 2340cm^4 > 360.65cm^4

Padstones to Beam 2,

Reaction = 7.99kN/m x 3.4m/2 = 13.58kN

Allowable Bearing Stress = 1.0N/mm^2

Use Dense Concrete Padstone 215mm Long x 100mm Wide x 140mm Deep for Beam 2

Padstones to have a minimum compressive strength of 40N/mm^2

Steel Beam to have a minimum end bearing length of 100mm

1.0N/mm^2 x 215mm x 100mm/10^3 = 21.5kN > 13.58kN

Beams 1 & 2 bolted together with M12 bolts and CHS spacer tubes at 600mm centres.

Notes

These structural calculations are based upon information provided by the client, should any variation between site conditions and the information provided by the client be identified, these calculations will be void.

Construction work not to be started until calculations have been approved by Building Control.

All construction work should be carried out by a competent builder.

The builder is responsible for all temporary supports and is to ensure that the structure is adequately supported during the works.

Steel beams are heavy components and may require mechanical lifting aids.

All weak or damaged masonry is to be re-built.

Existing foundations are assumed to be adequate, however, this is subject to exposing the existing foundations and an inspection for the satisfaction of the Building Control Officer.

Steel beam end bearings not to be located above lintels or openings.

Steel beam end bearings not to clash with or be located near the end bearings of existing beams or existing lintels.

Steel beam end bearing not to be inserted into a chimney or chimney breast.

Steel beam end bearing not to be located within 50mm of a flue.

Steel beam end bearings to be located on substantial load bearing masonry walls or piers. Plan area of bonded masonry supporting steel beam to be greater than or equal to 0.1m^2.

The minimum end bearing length at supports to be 100mm.

Supporting masonry to comply with Eurocode 6 or BS 5628.

Steel beams to be encased in fireline board to achieve 1/2 hour fire resistance in accordance with manufacturer's recommendations.

No point loads or concentrated loads are to be applied to the steel beam.

The ends of every load bearing wall should be bonded or otherwise securely tied throughout the full height of the wall to a buttressing return wall, the return wall should not be less than 665mm long.

Walls exceeding 9m long should be provided with intermediate buttressing support (wall, pier, chimney). Intermediate buttressing walls should not be less than 550mm long.

Buttressing end return walls and intermediate buttressing supports should be provided in accordance with Approved Document 'A', which can be downloaded from the following website; www.planningportal.gov.uk.

CDM Regulations - Under the Construction (Design & Management) Regulations 2015 for commercial clients, the client duties apply in full. For Domestic clients, the client duties pass on to the Principal Contractor or Sole Contractor. For more information visit www.hse.gov.uk.