

2 P S Design		PAGE:	1
PROJECT:	1 THE MEWS, DEVIZES	CALCS BY:	KP
ELEMENT:	STRUCTURAL CALCULATIONS	DATE:	12/02/2026

Note

Dimensions in these calculations are for structural purposes only, having been scaled from copies of drawings. The building contractor is to obtain detailed dimensions from site measurements.

The contractor is responsible for ensuring the stability of the structure at all times and that the works are carried out in accordance with the Construction, Design and Management Regulations.

These calculations only apply to the elements included in these documents. If any discrepancies are found on site the Engineer is to be informed.

General loading data

Pitched roof load

$$\text{Weight of rafters} = 0.15 \times 0.05 \times 6 \times 1000/400 = 0.12 \text{ kN/m}^2$$

$$\text{Weight of tiles, = say } 0.7 \text{ kN/m}^2$$

$$\text{Weight of battens, felt, insulation etc = say } 0.18 \text{ kN/m}^2$$

$$\text{Total roof dead load} = 0.12 + 0.7 + 0.18 = 1.0 \text{ kN/m}^2$$

$$\text{Roof imposed load (snow)} = 0.75 \text{ kN/m}^2$$

$$\text{Total roof load (unfactored)} = 1.0 + 0.75 = \underline{1.75 \text{ kN/m}^2}$$

$$\text{Roof load at ULS} = (1.4 \times 1.0) + (1.6 \times 0.75) = \underline{2.6 \text{ kN/m}^2}$$

Floor load

$$\text{Weight of 150 mm thick concrete floor} = 23.6 \times 0.15 = 3.6 \text{ kN/m}^2$$

$$\text{Weight of screed} = 1.8 \text{ kN/m}^2$$

$$\text{Weight of plasterboard ceiling and skim coat} = 0.3 \text{ kN/m}^2$$

$$\text{Total dead load} = 3.6 + 1.8 + 0.3 = 5.7 \text{ kN/m}^2$$

$$\text{Floor imposed load} = 1.5 \text{ kN/m}^2$$

$$\text{Total floor load (unfactored)} = 5.7 + 1.5 = \underline{7.2 \text{ kN/m}^2}$$

$$\text{Floor loading at ULS} = (1.4 \times 5.7) + (1.6 \times 1.5) = \underline{10.4 \text{ kN/m}^2}$$

2 P S Design		PAGE:	2
PROJECT:	1 THE MEWS, DEVIZES	CALCS BY:	KP
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Partition wall load

Weight of 215 thick leaf of bricks or blocks = 2.5 kN/m^2

Weight of plaster lining = 0.5 kN/m^2

Total weight = $2.5 + 0.5 = \underline{3.0 \text{ kN/m}^2}$

Weight at ULS = $1.4 \times 3.0 = \underline{4.2 \text{ kN/m}^2}$

2 P S Design		PAGE:	3
PROJECT:	1 THE MEWS, DEVIZES	CALCS BY:	KP
ELEMENT:	STRUCTURAL CALCULATIONS	DATE:	12/02/2026

Load on beam between kitchen and lounge

Udl from ceiling

$$\text{Load} = 10.4 \times 4.8 \times 0.5 = 25.0 \text{ kN/m}$$

Udl from first floor

$$\text{Load} = 10.4 \times 4.8 \times 0.5 = 25.0 \text{ kN/m}$$

Udl from partition wall

$$\text{Load} = 4.2 \times 4.3 = 18.1 \text{ kN/m}$$

From beam self weight

$$\text{Load at ULS} = 1.4 \times 0.5 = 0.7 \text{ kN/m}$$

$$\text{Total udl on beam} = 25.0 + 25.0 + 18.1 + 0.7 = \underline{68.8 \text{ kN/m}}$$

Design Moment and Shear Force

$$\text{Maximum span between centres of supports} = 2.9 \text{ m}$$

$$\text{Maximum bending moment, } M = 68.8 \times 2.9 \times 2.9 / 8 = \underline{72.4 \text{ kNm}}$$

$$\text{Maximum shear force, } F_v = 68.8 \times 2.9 / 2 = \underline{99.8 \text{ kN}}$$

From page 4 use 203 x 203 x 46 kg/m UC

Check deflection

$$\text{Allowable} = 2900 / 360 = 8.0 \text{ mm}$$

$$\text{Actual} = 5 \times 68.8 \times 2.9 \times 2900^3 / 1.5 \times 384 \times 205 \times 4570 \times 10^4 = 4.5 \text{ mm}$$

Therefore ok

2 P S Design		PAGE: 4
PROJECT: 1 THE MEWS, DEVIZES		BY: KP
ELEMENT: BEAM BETWEEN KITCHEN AND LOUNGE		DATE: 12/02/2026
<u>Reference</u>		
(to BS 5950: Part 1:2000)	Design bending moment, M =	72.40 kNm
	Design shear force, F_v =	99.80 kN
	Span between lateral supports, L =	2.900 m
	Steel grade selected =	S275
Table 9	Section selected =	203 x 203 x 46 UC
Table 11	Steel strength, p_y =	275 N/mm ²
	$e = (275/p_y)^{0.5}$ =	1.00
	Flange thickness, T =	11.0 mm
	Web thickness, t =	7.2 mm
Section tables	Overall depth, D =	203.2 mm
	b/T =	9.25
	d/t =	22.30
Table 11	Section is Class	2 (compact)
4.2.3	Shear area, $A_v = t.D$ =	1463 mm ²
4.2.3	Shear capacity, $P_v = 0.6p_yA_v$ =	241.40 kN
	Shear ratio F_v/P_v =	0.41
	The shear load is	Low
4.2.3	d/t < 70, hence no need to check for web shear buckling	
Section tables	Plastic section modulus, S =	497 cm ³
	Elastic section modulus, Z =	450 cm ³
4.2.5.2	For class 1 and 2 sections moment capacity, $M_c = p_y S$ =	136.68 kNm
4.2.5.1	Moment capacity limit for simply supported beam = $1.2p_y Z$ =	148.50 kNm
	Moment capacity is lesser of above values, hence M_c =	136.68 kNm
4.2.2	Section is not fully restrained against lateral torsional buckling between supports	
Table 13	Effective length, L_E =	1.2 L
	+ 2.0 D	
	Hence effective length, L_E =	3886 mm
	Radius of gyration, r_y =	5.13 cm
4.3.6.9	Ratio b_w =	1.0
	$b_w^{0.5} \cdot L_E / r_y$ =	75.8
	D/T =	18.5
Table 20	Bending strength, p_b =	218 N/mm ²
4.3.7	Buckling resistance moment, $M_b = p_b S$ =	108.42 kNm

2 P S Design		PAGE:	5
PROJECT:	1 THE MEWS, DEVIZES	CALCS BY:	KP
ELEMENT:	STRUCTURAL CALCULATIONS	DATE:	12/02/2026

Beam End Bearing (Reference to BS 5628 Part 1)

The beam has its ends bearing on the internal leaf of the cavity wall and the loadbearing partition wall.

The bearings on the walls are assumed to be Bearing Type 2 as shown at Figure 4 of BS 5628.

End reactions for beams

Maximum wall reactions = 99.8 kN

For an end bearing at the wall of 100 mm, and a beam width of 203 mm, the bearing stress under the beam = $99.8 \times 1000 / 100 \times 203 = 4.92 \text{ N/mm}^2$

For a Type 2 bearing the permissible stress = $1.5f_k/\gamma_m$

$\gamma_m = 3.5$ hence permissible stress = $1.5/3.5 f_k = 0.42 f_k$

Hence wall strength required = $4.92 / 0.42 = 11.70 \text{ N/mm}^2$

Use a concrete padstone.

Bearing stress under the padstone = $99.8 \times 1000 / 100 \times 750 = 1.33 \text{ N/mm}^2$

Wall strength required under padstone = $1.33 / 0.42 = 3.16 \text{ N/mm}^2$

Hence, providing supporting walls are constructed with standard format solid concrete blocks or bricks (minimum $f_k = 3.5 \text{ N/mm}^2$) the arrangement is OK.

Use concrete lintel as padstone 100 x 750 x 215 deep

