

LOADINGS.

CALCULATIONS FOR INTERNAL BEAM 2.93 LONG.

Wall Loading

Loading of single skin wall 100mm thick,

$$\text{Area of wall} = 2.930 \times (4.423 + 2.349)/2 = 9.92\text{M}^2$$

$$\text{Load per leaf of cavity wall} = 9.92 \times 219\text{kg} = 2172.5\text{kg} = 21.3\text{kN}$$

$$\text{Unit load per metre} = 21.3/2.93 = 7.27\text{kN/m}$$

CALCULATIONS FOR BEAMS

Beam:

LoadName	Loading W1	Start x 1	Loading W2	R1 comp	R2 comp	Defl
Ow	0.15	0		0.22	0.22	0.14
U T UDL	7.27	0		<u>10.65</u>	<u>10.65</u>	<u>6.98</u>
	TOTAL LOAD = 21.74			10.87	10.87	7.12

Maximum B.M. = 7.96kN at 1.47m from R1

Maximum S.F = 10.87kN 0.00m at R1

$$\text{Total mid span deflection} = 7.12 \times 10^8 / EI$$

Steel calculations to BS449 Part2 using s355steel

SECTION SIZE: 127 x 76 x 13UB.

$$D=127.0\text{mm} \quad B=76.0\text{mm} \quad t=4\text{mm} \quad T=7.6\text{mm} \quad I_x=473\text{cm}^4 \quad r_y=1.84\text{cm} \quad Z_x=74.6\text{cm}^3$$

Bending:

$$\text{Effective Length, } L_e = 2.93\text{m.} \quad L_e/r_y = 2.93 \times 100/1.84 \approx 159 \quad D/T = 16.7$$

$$\text{Permissible bending stress, } p_{bc} = 125\text{N/mm}^2 \text{ (Table 3a)}$$

Actual bending stress, $f_{bc} = 7.96 \times 100 = 107\text{N/mm}$ OK/74.6 OK

Shear:

Permissible shear stress, $p_s = 140\text{N/mm}^2$ (Table 11)

Maximum shear in web, $f_s = 10.87 \times 1000 / (4.0 \times 127) = 21.4\text{N/mm}^2$ OK
($p_s = 110\text{N/mm}^2$)

Beam Web.

Check unstiffened web capacity with load of 10.87kN

Bearing: $p_b = 260\text{N/mm}^2$ (Table 9); $C1 = 27.4\text{kN}$ $C2 = 104\text{kN/mm}$

Buckling : $p_c = 192\text{N/mm}^2$ (Table 17b); $C1 = 48.8\text{kN}$; $C2 = 0.769\text{kN/mm}$

Minimum required stiff bearing length, $L_b = 0\text{mm}$ P_w

Bearing capacity $P_w = C1 + L_b.C2 = 27 = C1 + L_b.4\text{kN}$ OK

Buckling capacity, $P_x = C1 + L_b.C2 = 48.8\text{kN}$

Deflection.

Total deflection = $7.12 \times 1\text{el} / (205000 \times 437) = 7.3\text{mm}$ (L/399) OK

Combined bending and shear check

Check $(f_{bc}/p_{bc})^2 + (f_s/p_s) = 0.729 + 0.00 = 0.729$ at 1.47 OK

Bearings.

Factored reaction = $1.40 \times 10.87 = 15.22\text{kN}$

R1; 226 x 100mm padstone.

Design strength of masonry (factored) = 0.700N/mm^2

Factored stress under padstone = $15.22 \times 1000 / 225 \times 100 = 0.68$ OK