Solution: C1 Example. Concentrated load under a bearing

Each beam transfers to the wall a dead load of 5,5 KN and a live load of 4 KN.

The design value of the concentrated load N_{Edc} is therefore;

1,35 x 5,5 + 1,5 x 4 = 13.43 KN

The centroid of the concentrated load is applied at

(140x0,5)-(100x0,5) = 20 mm

or 0,143t from the centreline of the wall and is therefore within the limit of 0,25t.

For Group 1 masonry units laid with a full bed of mortar the vertical concentrated load resistance of the wall N_{Rdc} is given by

$$N_{Rdc} = \beta A_b f_d$$

Where A_b is the loaded area and f_d is the design compressive strength of the masonry in the direction being considered and

$$\beta = \left(1 + 0{,}3\frac{a_1}{h_c}\right)\left(1{,}5 - 1{,}1\frac{A_b}{A_{ef}}\right)$$

but not less than 1,0 nor greater than 1,25 + $\frac{a_1}{2h_c}$ or 1,5 whichever is the lesser

where a_1 is the distance from the end of the wall to the nearer edge of the loaded area

h_c is the height of the wall at the level of the load

A_{ef} is the effective area of bearing = $l_{efm}\ t$

Where l_{efm} is the effective length of the bearing as determined at the mid height of the wall or pier and t is the thickness of the wall, taking into account the depth of recesses in joints greater than 5mm.

Note that A_b/A_{ef} is not to be taken greater than 0,45.

Case 1: intermediate bearings

l_{efm} at the mid height of the wall is given by

2(2900x0,5xtan30) + 125 = 1799 mm

$$\frac{A_b}{A_{ef}} = \frac{100\text{x}125}{1799\text{x}140} = 0{,}05$$

which is less than the limiting value of 0,45.

$$B = \left(1 + \frac{0{,}3\text{x}900}{2900}\right)\left(1{,}5 - 1{,}1\left(\frac{125\text{x}100}{1799\text{x}140}\right)\right) = 1{,}58$$

Check limiting value = $1{,}25 + \frac{900}{2\text{x}2900}$ = 1,41 or 1,50 whichever is the lesser.

Therefore β should be taken as 1,41.

Characteristic compressive strength of the masonry f_k given by

$f_k = K f_b^{\alpha} f_m^{b}$ = 0,55x6,6^{0,7}x4^{0,3} = 3,12 N/mm^2

Therefore $N_{Rdc} = \beta A_b f_d$ = 1,41x125x100x3,12x10^{-3}/2,7 = 20,37 kN.

This is greater than the applied load (13,44 kN) and therefore adequate.

Case 2: bearing at the end of the wall

l_{efm} at the mid height of the wall is given by

(2900x0,5xtan30)+125+150 = 1112mm

$$\frac{A_b}{A_{ef}} = \frac{100\text{x}125}{1112\text{x}140} = 0{,}08$$

which is less than the limiting value of 0,45.

$$B = \left(1 + \frac{0{,}3\text{x}150}{2900}\right)\left(1{,}5 - 1{,}1\left(\frac{125\text{x}100}{1112\text{x}140}\right)\right) = 1{,}43$$

Check limiting value = $1{,}25 + \frac{150}{2\text{x}2900}$ = 1,28 or 1,50 whichever is the lesser.

Therefore β should be taken as 1,28.

Characteristic compressive strength of the masonry f_k given by

$$f_k = K f_b^{\alpha} f_m^{b} = 0{,}55\text{x}6{,}6^{0{,}7}\text{x}4^{0{,}3} = 3{,}12 \text{ N/mm}^2$$

Therefore $N_{Rdc} = \beta A_b f_d$ = 1,28x125x100x3,12x10^{-3}/2,7 = 18,49 kN.

This is greater than the applied load (13,44 kN) and therefore adequate.

The bearing strength of the wall is adequate to support the concentrated loads applied by the precast concrete floor beam.

The wall will also need to be checked for vertical loading at the top, middle and base of the wall for vertical loading. At the middle of the wall account will need to be taken of any overlap of the spread of the concentrated loads as well the applied design vertical loads.