The characteristic strength f_k obtained from Table 4.5a should be multiplied by this factor in addition to the single skin factor of 1.15. Thus

$$250\,\text{N per mm run} = \frac{\beta t f_k \times 1.15 \times 0.854}{\gamma_m}$$

from which

$$f_k \text{ required} = \frac{250\gamma_m}{\beta t \times 1.15 \times 0.854} = \frac{250 \times 3.5}{0.62 \times 102.5 \times 1.15 \times 0.854}$$
$$= 14.02\,\text{N/mm}^2$$

Again by reference to Table 4.5a:

Use 50 N/mm^2 bricks in grade (i) mortar ($f_k = 15\,\text{N/mm}^2$), or use 70 N/mm^2 bricks in grade (ii) mortar ($f_k = 15.1\,\text{N/mm}^2$).

Example 4.2

A single skin wall constructed from 390 mm long × 190 mm high × 100 mm thick solid concrete blocks is built between concrete floors as shown in Figure 4.23. The ultimate axial load carried by the wall, including an allowance for the self-weight, is 125 kN per metre run. If the wall is 5 m long, what block and mortar strengths are required if special manufacturing control and normal construction control will apply?

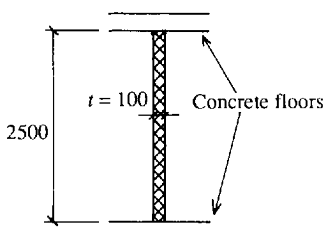

Figure 4.23 *Section through wall*

Since there are no intersecting walls the effective height will govern the slenderness. The effective height $h_{ef} = 0.75h = 0.75 \times 2500 = 1875$ mm, and the effective thickness t_{ef} is the actual thickness of 100 mm. Thus

$$SR = \frac{h_{ef}}{t_{ef}} = \frac{1875}{100} = 18.75 < 27$$

Thus the slenderness ratio is acceptable. By interpolation from Table 4.8, the capacity reduction factor β is 0.74.

The plan area of the 5 m long wall is $5 \times 0.1 = 0.5\,\text{m}^2$. This is greater than $0.2\,\text{m}^2$ and therefore the plan area reduction factor does not apply. Furthermore, it should be appreciated that the single skin factor used for the brick wall in Example 4.1 does not apply to walls constructed from blocks.

The vertical design strength is $\beta t f_k/\gamma_m$. Thus

$$125 = \frac{\beta t f_k}{\gamma_m}$$

from which

$$f_k \text{ required} = \frac{125\gamma_m}{\beta t} = \frac{125 \times 3.1}{0.74 \times 100} = 5.24\,\text{N/mm}^2$$

Now the blocks to be used are solid concrete 390 mm long × 190 mm high × 100 mm thick, for which the ratio of the block height to the lesser horizontal dimension is 390/100 = 3.9. Therefore f_k should be obtained from Table 4.5d:

Use 7 N/mm^2 solid blocks in grade (iv) mortar ($f_k = 5.6\,\text{N/mm}^2$).

Example 4.3

A ground floor wall in a three-storey building supports the loads indicated in Figure 4.24. Choose suitable bricks and mortar for the wall. Partial safety factors are given as follows: for materials, $\gamma_m = 2.8$; for dead loads, $\gamma_f = 1.4$; for imposed loads, $\gamma_f = 1.6$. The manufacturing control is to be normal and the construction control is to be special.

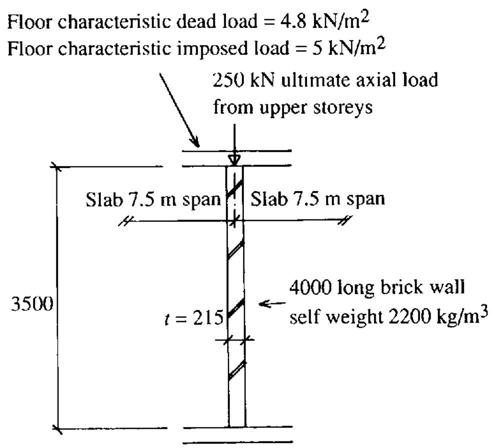

Figure 4.24 *Section through wall*

Consider a 1 m length of wall for the purpose of design.

The ultimate design load from the upper storey has been given, but to this must be added the first-floor loading and the self-weight of the ground floor wall itself. Hence the characteristic dead load G_k is calculated as follows:

Floor: $4.8 \times 7.5 \times 1 =$ 36

Wall SW: $\frac{2000}{100} \times 3.5 \times 0.215 \times 1 = 16.56$

Total G_k: 52.56 kN

The characteristic imposed load will be $Q_k = 5 \times 7.5 \times 1 = 37.5\,\text{kN}$. Hence

Ultimate design dead and imposed load

$$= \gamma_f G_k + \gamma_f Q_k = 1.4 \times 52.56 + 1.6 \times 37.5 = 73.58 + 60 = 133.58\,\text{kN per metre run}$$

To this must be added the ultimate design load from the upper storeys of 250 kN per metre run. Hence

Total ultimate axial load $= 250 + 133.58 = 383.58\,\text{kN/m} = 383.58\,\text{N per mm run}$

The effective height $h_{ef} = 0.75h = 0.75 \times 3500 = 2625\,\text{mm}$, and the effective thickness t_{ef} is the actual thickness of 215 mm. Note that since the thickness of this brick wall is greater than a standard format brick, the thickness factor 1.15 does not apply. Thus the slenderness ratio is given by

$$\text{SR} = \frac{h_{ef}}{t_{ef}} = \frac{2625}{215} = 12.2 < 27$$

This is satisfactory. From Table 4.8, the capacity reduction factor β is 0.93.