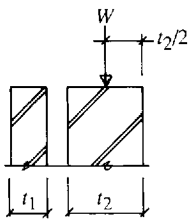

Figure 4.21 *Cavity wall with only one leaf loaded*

axial load it supports using the appropriate expression 4.1 or 4.2; the effective thickness of the wall for the purpose of obtaining the capacity reduction factor from Table 4.8 is that of the cavity wall or column.

The load from a roof or floor is often only supported by one leaf of a cavity wall, as shown in Figure 4.21. Then the design strength should be calculated using the thickness of that leaf alone in the relevant expression 4.1 or 4.2. The effective thickness used for obtaining the capacity reduction factor is again that of the cavity wall, thus taking into account the stiffening effect of the other leaf.

The general procedure for determining the vertical design strength of a wall or column may be summarized as follows.

4.10.1 Design summary for a vertically loaded wall or column

(a) Calculate the slenderness ratio for the wall or column under consideration.

(b) Obtain the capacity reduction factor β from Table 4.8 corresponding to the slenderness ratio and taking into account any eccentricity of loading.

(c) Obtain the characteristic compressive strength f_k of the masonry units from the relevant part of Table 4.5, adjusting if necessary for the plan area or shell bedding.

(d) Select the material partial safety factor γ_m from Table 4.6 in relation to the standard of quality control that will be exercised.

(e) Calculate the vertical load resistance using expression 4.1 for walls or expression 4.2 for columns.

Whilst following this procedure, particular care needs to be exercised by the designer to ensure that all the factors that can influence the slenderness ratio are taken into consideration. Let us therefore look at a number of examples using this procedure which attempt to highlight those various factors.

Example 4.1

A 102.5 mm thick single skin brick wall, as shown in Figure 4.22, is built between the concrete floors of a multi-storey building. It supports an ultimate axial load,

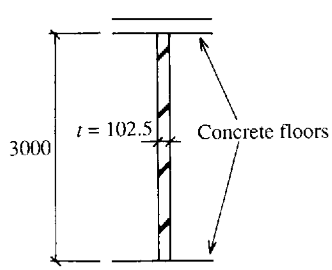

Figure 4.22 *Section through wall*

including an allowance for the self-weight, of 250 kN per metre run. What brick and mortar strengths are required if normal manufacturing and construction controls apply and the wall is first 10 m long and secondly only 1 m long?

Wall 10 m long

Since the wall in this instance is not provided with any vertical lateral supports along its 10 m length, the slenderness ratio should be based upon its effective height. Furthermore, as the concrete floor is continuous over the wall, by reference to Figure 4.5 enhanced lateral resistance will be provided in the horizontal direction.

The effective height of the wall $h_{ef} = 0.75h = 0.75 \times 3000 = 2250$ mm, and the effective thickness of a solid wall is the actual thickness of 102.5 mm. Thus the slenderness ratio is given by

$$\mathrm{SR} = \frac{\text{effective height}}{\text{effective thickness}} = \frac{h_{ef}}{t_{ef}} = \frac{2250}{102.5} = 21.95 < 27$$

Thus the slenderness ratio is acceptable. From Table 4.8, the capacity reduction factor β is 0.62.

Since the wall is 10 m long, the plan area is $10 \times 0.1025 = 1.025\,\mathrm{m}^2$. This is greater than $0.2\,\mathrm{m}^2$ and therefore the plan area reduction factor does not apply.

Now the ultimate vertical load is 250 kN per metre run or 250 N per millimetre run. The expression for the vertical design strength of a wall is $\beta t f_k/\gamma_m$. Therefore

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

The material partial safety factor γ_m is selected from Table 4.6 in relation to the standard of manufacture and construction control. In this instance it is normal for both manufacture and construction, and γ_m will therefore be 3.5. Furthermore, since the thickness of the wall is equal to the width of a single brick, the value of f_k may be multiplied by 1.15. Hence

$$250 = \frac{\beta t f_k \times 1.15}{\gamma_m}$$

from which

$$f_k\ \text{required} = \frac{250\gamma_m}{\beta t \times 1.15} = \frac{250 \times 3.5}{0.62 \times 102.5 \times 1.15} = 11.97\ \mathrm{N/mm^2}$$

Comparing this value with the characteristic strength of bricks given in Table 4.5a, suitable bricks and mortar can be chosen:

Use 50 N/mm^2 bricks in grade (ii) mortar ($f_k = 12.2\ \mathrm{N/mm^2}$).

Wall 1 m long

In this instance the plan area of the wall is $1 \times 0.1025 = 0.1025\,\mathrm{m}^2$. This is less than $0.2\,\mathrm{m}^2$, and hence the small plan area modification factor should be applied:

Modification factor $= (0.7 + 1.5A) = (0.7 + 1.5 \times 0.1025) = 0.854$