# 5

# Design for compressive loading

## 5.1 INTRODUCTION

This chapter deals with the compressive strength of walls and columns which are subjected to vertical loads arising from the self-weight of the masonry and the adjacent supported floors. Other in-plane forces, such as lateral loads, which produce compression are dealt with in Chapter 6.

In practice, the design of loadbearing walls and columns reduces to the determination of the value of the characteristic compressive strength of the masonry ($f_k$) and the thickness of the unit required to support the design loads. Once $f_k$ is calculated, suitable types of masonry/mortar combinations can be determined from tables, charts or equations.

As stated in Chapter 1 the basic principle of design can be expressed as

$$\text{design vertical loading} \leqslant \text{design vertical load resistance}$$

in which the term on the left-hand side is determined from the known applied loading and the term on the right is a function of $f_k$, the slenderness ratio and the eccentricity of loading.

## 5.2 WALL AND COLUMN BEHAVIOUR UNDER AXIAL LOAD

If it were possible to apply pure axial loading to walls or columns then the type of failure which would occur would be dependent on the slenderness ratio, i.e. the ratio of the effective height to the effective thickness. For short stocky columns, where the slenderness ratio is low, failure would result from compression of the material, whereas for long thin columns and higher values of slenderness ratio, failure would occur from lateral instability.

A typical failure stress curve is shown in Fig. 5.1.

The actual shape of the failure stress curve is also dependent on the properties of the material, and for brickwork, in BS 5628, it takes the form of the uppermost curve shown in Fig. 4.4 but taking the vertical axis to

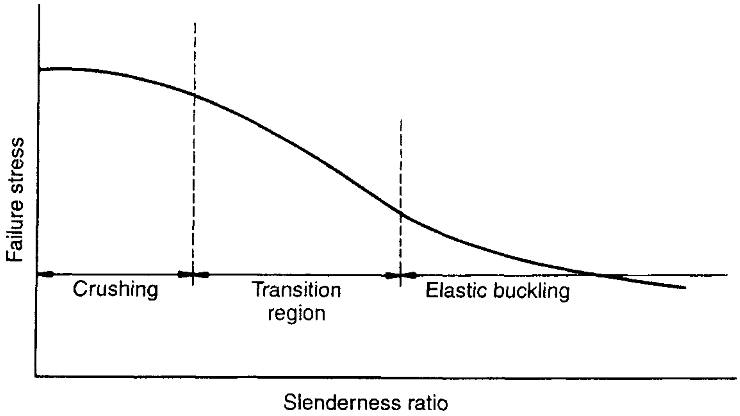


**Fig. 5.1** Failure stress plotted against slenderness ratio.

represent the failure stress rather than *ß*. The failure stress at zero slenderness ratio is dependent on the strength of masonry units and mortar used in the construction and varies between 7.0 and 24 $N/mm^2$.

## 5.3 WALL AND COLUMN BEHAVIOUR UNDER ECCENTRIC LOAD

It is virtually impossible to apply an axial load to a wall or column since this would require a perfect unit with no fabrication errors. The vertical load will, in general, be eccentric to the central axis and this will produce a bending moment in the member (Fig. 5.2).

The additional moment can be allowed for in two ways:

1. The stresses due to the equivalent axial loads and bending moments can be added using the formula

$$\text{total stress} = P/A \pm M/Z$$

   where $A$ and $Z$ are the area and section modulus of the cross-section.
2. The interaction between the bending moment and the applied load can be allowed for by reducing the axial load-carrying capacity, of the wall or column, by a suitable factor.

### 5.3.1 BS 5628

The second method is used in BS 5628. The effects of slenderness ratio and eccentricity are combined and appear in the code as the *capacity reduction factor ß*. In the code values of *ß* are given in tabular form based