5.4.1 Effective height

The effective height is related to the degree of restraint imposed by the floors and beams which frame into the wall or columns.

Theoretically, if the ends of a strut are free, pinned, or fully fixed then, since the degree of restraint is known, the effective height can be calculated (Fig. 5.3) using the Euler buckling theory.

In practice the end supports to walls and columns do not fit into these neat categories, and engineers have to modify the above theoretical values in the light of experience. For example, a wall with concrete floors framing into the top and bottom, from both sides (Fig. 5.4), could be considered as partially fixed at both ends, and for this case the effective length is taken as $0.75h$, i.e. half-way between the 'pinned both ends' and the 'fixed both ends' cases.

In the above example it is assumed that the degree of fixity is half-way between the pinned and fixed case, but in reality the degree of fixity is dependent on the relative values of the stiffnesses of the floors and walls. For the case of a column with floors framing into both ends, the stiffnesses of the floors and columns are of a similar magnitude and the effective height is taken as h, the clear distance between lateral supports (Fig. 5.4).

(a) BS 5628

In BS 5628 the effective height is related to the degree of lateral resistance to movement provided by supports, and the code distinguishes between two types of resistance—simple and enhanced. The term *enhanced resistance* is intended to imply that there is some degree of rotational restraint at the end of the member. Such resistances would arise, for example, if floors span to a wall or column from both sides at the same level or where a concrete floor on one side only has a bearing greater than 90 mm and the building is not more than three storeys.
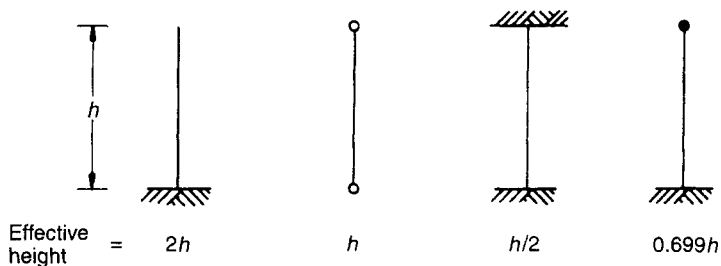

Fig. 5.3 Effective height for different end conditions.
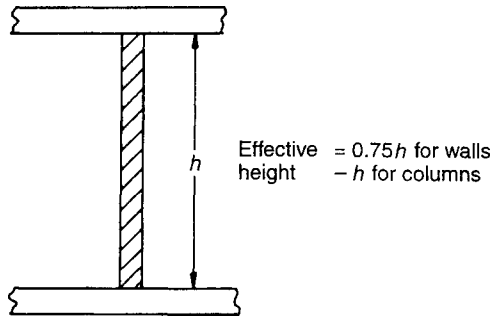
Fig. 5.4 Effective height for wall/floor and wall/column arrangement.

Conventional values of effective height recommended in BS 5628 are:

- *Walls*
  Enhanced resistance

$$h_{ef}=0.75h$$

  Simple resistance

$$h_{ef}=h$$

- *Columns*
  With lateral supports in two directions

$$h_{ef}=h$$

  With lateral support in one direction

$$h_{ef}=h \text{ (in lateral support direction)}$$

$$h_{ef}=2h \text{ (in direction in which support is not provided)}$$

- *Columns formed by adjacent openings in walls*
  Enhanced resistance

$$h_{ef}=0.75h+0.25\times(\text{height of the taller of the two openings})$$

  Simple resistance

$$h_{ef}=h$$

(b) ENV 1996–1–1

In the Eurocode the effective height is taken as:

$$h_{ef}=\rho_n h \hspace{3cm} (5.6)$$