$$\lambda_y = \frac{L_{Ey}}{r_y} = \frac{2500}{51.6} = 48 < 180$$

These are satisfactory.

The relevant strut tables to use, as determined from Table 5.11, are the same as in Example 5.11. Hence

For $\lambda_x = 56$ and $p_y = 275\,\text{N/mm}^2$: $p_c = 227\,\text{N/mm}^2$

For $\lambda_y = 48$ and $p_y = 275\,\text{N/mm}^2$: $p_c = 224\,\text{N/mm}^2$

It should be noted that even though the slenderness about the x–x axis is greater than that about the y–y axis, the lower value of p_c for λ_y will be the design criterion. Therefore p_c for design is $224\,\text{N/mm}^2$.

The compression resistance is given by

$$P_c = A_g p_c = 66.4 \times 10^2 \times 224 = 1\,487\,360\,\text{N} = 1487\,\text{kN} > 1400\,\text{kN}$$

That is, $P_c > F$. Thus:

Adopt 203 × 203 × 52 kg/m UC.

The value of P_{cy} given in Table 5.12 for this section is 1480 kN.

It should be appreciated that the purpose of this example is not to advocate the introduction of tie beams in order to reduce the effective length of columns, but to illustrate the advantage of taking such beams or similar members into account when they are already present.

Figure 5.33 illustrates the effect on the slenderness that a similar mid-height tie would have if the column had been restrained in position and direction at both the cap and the base. The design procedure for the column would then be exactly the same as this example.

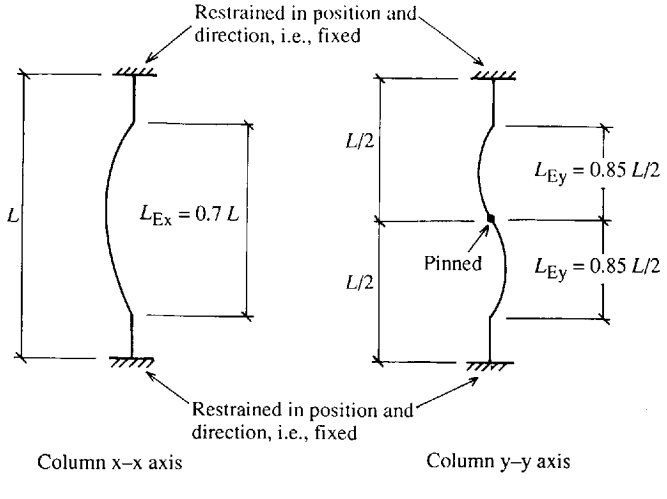


Figure 5.33 *Column effective lengths*

5.12.3 Axially loaded columns with nominal moments

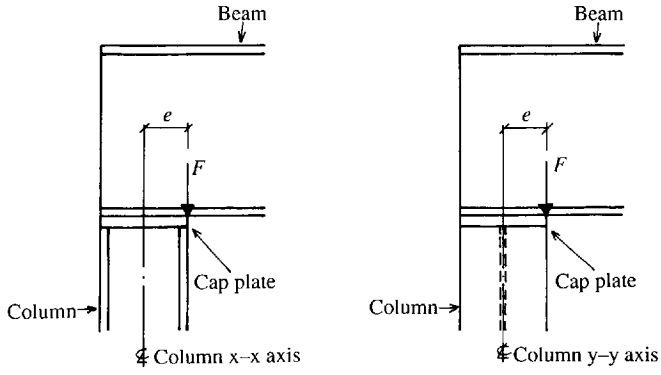
The design of steel elements dealt with in this manual is based upon the principles of simple design. This assumes that the end connections between members are such that they cannot develop any significant restraint moments.

In practice the loads supported by columns are seldom applied concentrically, and therefore the effect of eccentric loading should be considered. For simple construction, where the end connections are not intended to transmit significant bending moments, the degree of eccentricity may be taken as follows:

(a) For a beam supported on a column cap plate, such as that shown in Figure 5.34a or b, the load is taken as acting at the face of the column.

(b) Where beams are connected by simple connections to the face of a column, as in Figure 5.35a and b, the load should be taken as acting at 100 mm from the column face, as shown in Figure 5.36.

(c) When a roof truss is supported on a column cap plate, as shown in Figure 5.37, and the connection cannot develop significant moments, the eccentricity may be neglected.



(a) Beam spanning at right angles to the x–x axis

(b) Beam spanning at right angles to the y–y axis

Figure 5.34 *Beams supported on a column cap plate*

A load applied eccentrically will induce a nominal bending moment in the column equal to the load times the eccentricity:

$$M_e = Fe$$

The effect on the column of this moment must be examined in conjunction with the axial load.