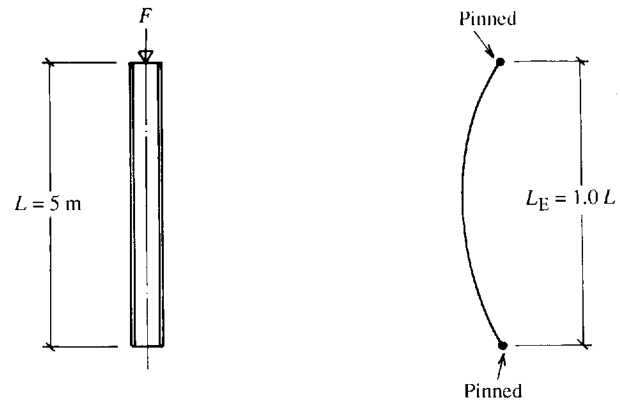

Figure 5.41 *Effective length of column*

$r_x = r_x$ of uncased section $= 9.27\,\text{cm} = 92.7\,\text{mm}$
r_y of uncased section $= 5.32\,\text{cm} = 53.2\,\text{mm}$
r_y of cased section $= 0.2b_c = 0.2 \times 308.8 = 61.8\,\text{mm}$
Effective length $L_E = L = 5000\,\text{mm}$

Check that the effective length does not exceed the limiting values for a cased column:

$$40b_c = 40 \times 308.8 = 12\,352\,\text{mm} > 5000\,\text{mm}$$

$$\frac{100b_c^2}{d_c} = \frac{100 \times 308.8^2}{322.3} = 29\,587\,\text{mm} > 5000\,\text{mm}$$

$$250r_y \text{ of uncased section} = 250 \times 53.2 = 13\,300 > 5000\,\text{mm}$$

Here $T = 20.5\,\text{mm} > 16\,\text{mm}$. Therefore $p_y = 265\,\text{N/mm}^2$. The slenderness values are given by

$$\lambda_x = \frac{L_E}{r_x} = \frac{5000}{92.7} = 54 < 180$$

$$\lambda_y = \frac{L_E}{r_y} = \frac{5000}{61.8} = 81 < 180$$

These are satisfactory.

The relevant BS 5950 strut tables to use may be determined from Table 5.11. For buckling about the x–x axis use Table 27b; for buckling about the y–y axis use Table 27c. Hence

For $\lambda_x = 54$ and $p_y = 265\,\text{N/mm}^2$: $p_c = 223\,\text{N/mm}^2$
For $\lambda_y = 81$ and $p_y = 265\,\text{N/mm}^2$: $p_c = 155\,\text{N/mm}^2$

Therefore p_c for design is $155\,\text{N/mm}^2$.

The compression resistance is given by

$$P_c = \left(A_g + 0.45\frac{f_{cu}}{p_y}A_c\right)p_c$$

$$= \left(110 \times 10^2 + 0.45 \times \frac{20}{265} \times 99\,526\right)155$$

$$= (11\,000 + 3380)155 = 14\,380 \times 155 = 2\,228\,900\,\text{N} = 2229\,\text{kN}$$

This must not be greater than the short strut capacity P_{cs} of the section, given by

$$P_{cs} = \left(A_g + 0.25\frac{f_{cu}}{p_y}A_c\right)p_y$$

$$= \left(11\,000 + 0.25 \times \frac{20}{265} \times 99\,526\right)265$$

$$= (11\,000 + 1878)265 = 12\,878 \times 265 = 3\,412\,670\,\text{N} = 3413\,\text{kN} > 2229\,\text{kN}$$

Therefore the compression resistance of the cased column is 2229 kN. This may be compared with the compression resistance of 1463 kN for the same section uncased that was calculated in Example 5.11. Thus the load capacity of the section when cased has increased by 52 per cent.

5.12.6 Column baseplates

The column designs contained in this manual relate to axially loaded columns and columns subject to nominal moments at the cap. Therefore only the design of baseplates subject to compressive loading will be included here.

Empirical rules are given in BS 5950 for the design of slab baseplates, as illustrated in Figure 5.42, when subject to compressive loads only. When a column is concentrically loaded it may be assumed that the load at the base is transmitted uniformly over the area of the steel baseplate to the foundation concrete.

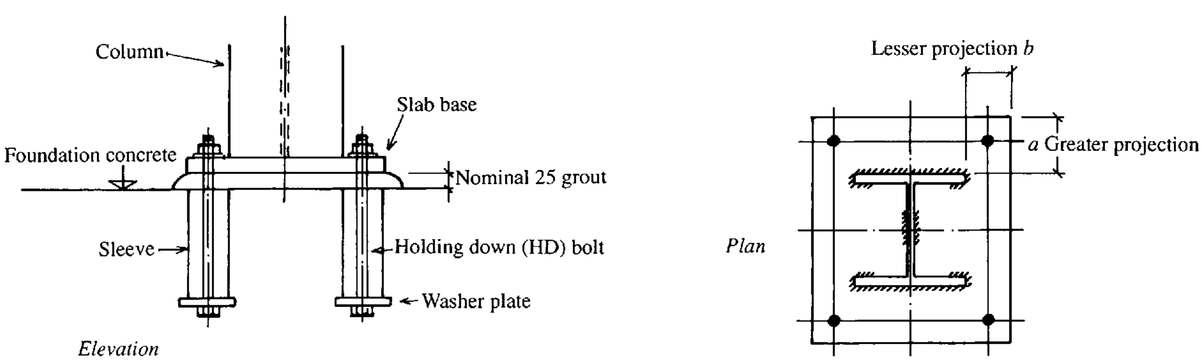

Figure 5.42 *Typical slab base*