3.6.2 Beams
Beams should be of sufficient depth to avoid the necessity for excessive compression reinforcement and to ensure that an economical amount of tension and shear reinforcement is provided. This will also facilitate the placing of concrete. For initial sizing the effective depth should therefore be determined from Table 4. If other considerations demand shallower construction, reference should be made to subsection 4.4.

Table 4 Span/effective depth ratios for initial design of beams

cantilever	6
simply supported	12
continuous	15

For spans greater than 10m the effective depth ratios should be multiplied by 10/(span in metres).

3.7 Sizing

3.7.1 Introduction
When the depths of slabs and beams have been obtained it is necessary to check the following:

- width of beams and ribs
- column sizes and reinforcement
- shear in flat slabs at columns
- practicality of reinforcement arrangements in beams, slabs and at beam–column junctions.

3.7.2 Loading
Ultimate loads, i.e. characteristic loads multiplied by the appropriate partial safety factors, should be used throughout. At this stage it may be assumed that all spans are fully loaded, unless the members concerned are sensitive to unbalanced loading.

For purposes of assessing the self-weight of beams, the width of the downstand can be taken as half the depth but usually not less than 300mm.

3.7.3 Width of beams and ribs
The width should be determined by limiting the shear stress in beams to 2.0N/mm^2 and in ribs to 0.6N/mm^2 for concrete of characteristic strength $f_{cu} \geqslant 30\text{N/mm}^2$:

$$\text{width of beam (in mm)} = \frac{1000V}{2d} \qquad \text{width of rib (in mm)} = \frac{1000V}{0.6d}$$

where V is the maximum shear force (in kN) on the beam or rib, considered as simply supported and
d is the effective depth in mm.

For $f_{cu} < 30\text{N/mm}^2$ the width should be increased in proportion.

3.7.4 Sizes and reinforcement of columns
Stocky columns should be used, i.e. columns for which the ratio of the effective height to the least lateral dimension does not exceed 15, where the effective height equals 0.85 times the clear storey height.

The columns should be designed as axially loaded, but to compensate for the effect of eccentricities, the ultimate load from the floor immediately above the column being considered should be multiplied by the following factors:

For columns loaded by beams and/or slabs of similar stiffness on both sides of the column in two directions at right-angles to each other, e.g. some internal columns 1.25
For columns loaded in two directions at right-angles to each other by unbalanced beams and/or slabs, e.g. corner columns 2.00
In all other cases, e.g. facade columns 1.50

It is recommended that the columns are made the same size through at least the two topmost storeys, as the above factors may lead to inadequate sizes if applied to top storey columns for which the moments tend to be large in relation to the axial loads.

The ultimate loads that can be carried by columns of different sizes and different reinforcement percentages p may be obtained from Table 5 for f_{cu}=30N/mm^2 and f_y=460N/mm^2.

Table 5 Ultimate loads for stocky columns

Column size* mm × mm	Cross-sectional area, mm^2	p=1% kN	p=2% kN	p=3% kN	p=4% kN
300 × 300	90 000	1213	1481	1749	2016
300 × 350	105 000	1415	1728	2040	2353
350 × 350	122 500	1651	2016	2380	2745
400 × 350	140 000	1887	2304	2720	3137
400 × 400	160 000	2156	2633	3109	3585

*Provided that the smallest dimension is not less than 200mm, any shape giving an equivalent area may be used.

The values of the cross-sectional areas in Table 5 are obtained by dividing the total ultimate load, factored as above, by a 'stress' that is expressed as:

$$0.35f_{cu} + \frac{p}{100}(0.67f_y - 0.35f_{cu})$$

where f_{cu} is the characteristic concrete strength in N/mm^2
f_y the characteristic strength of reinforcement in N/mm^2 and
p the percentage of reinforcement.

3.7.5 Walls

Walls carrying vertical loads should be designed as columns. Shear walls should be designed as vertical cantilevers, and the reinforcement arrangement should be checked as for a beam. Where the walls have returns at the compression end, they should be treated as flanged beams.

3.7.6 Shear in flat slabs at columns

Check that:

$$\frac{1250\,w\ \text{(area supported by column)}}{\text{(column perimeter + 9h)d}} \leq 0.6\text{N/mm}^2$$