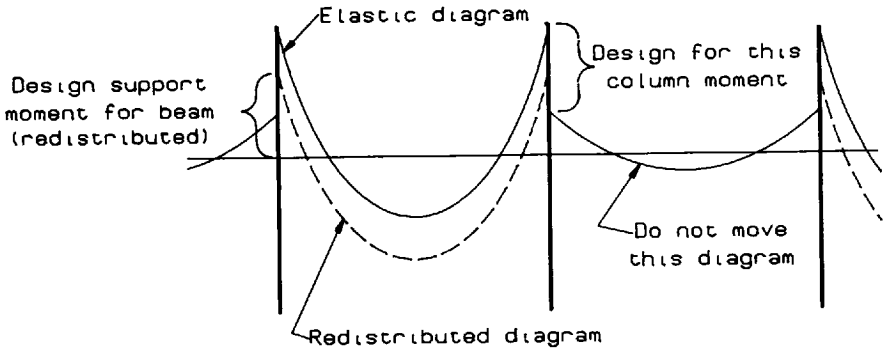
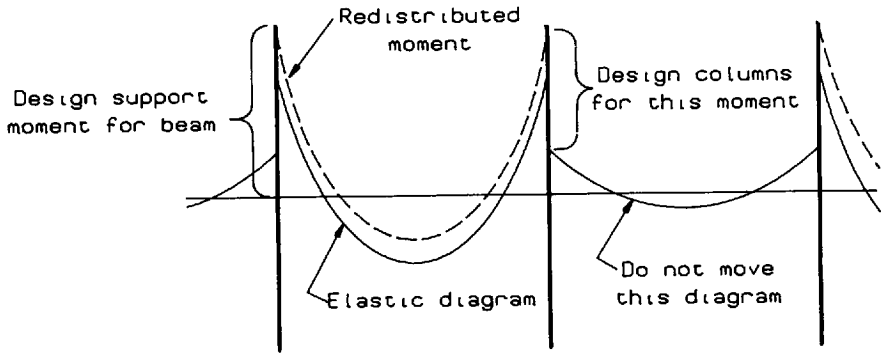


(a) Downward distribution of 'span loaded' diagram



(b) Upward movement of 'span loaded' diagram

10 Redistribution procedures for frames

4.4 Beams

4.4.1 Introduction

This subsection describes the final design of beams of normal proportions and spans. Deep beams with a clear span less than twice the effective depth are not considered.

The general procedure to be adopted is as follows:

1. check that the section complies with the requirements for fire resistance
2. check that cover and concrete comply with durability requirements
3. calculate bending moments and shear forces according to subsection 4.3 or clause 4.4.3*(b)*
4. check span/depth ratio and determine the compression steel (if any) required to limit deflection
5. calculate reinforcement.

The effective span of a simply supported beam should be taken as the smaller of the following:

(a) the distance between the centres of bearings, or
(b) the clear distance between supports plus the effective depth d of the beam.

The effective span of a beam continuous over its supports should normally be taken as the distance between the centres of the supports.

The effective length of a cantilever beam should normally be taken as its length to the face of the support plus half its effective depth. Where, however, it forms the end of a continuous beam, the length to the centre of the support should be used.

Slenderness: The clear distance between adequate lateral restraints to a beam should not exceed the lesser of

$60b_c$ or $250\ b_c^2/d$

where b_c is the width of the compression flange midway between the restraints. (This is not usually a limitation on beams for which a slab provides the compression flange at midspan.) For cantilevers, the length should not exceed the lesser of

$25\ b_c$, or $100b_c^2/d$.

In normal slab-and-beam or framed construction specific calculations for torsion are not usually necessary, torsional cracking being adequately controlled by shear reinforcement.

Where the arrangement of the structure is such that loads are imposed mainly on one face of a beam without corresponding rotational restraints being provided, torsion may be a problem. BS 8110[1] should be consulted for design for torsion.

4.4.2 Fire resistance and durability

4.4.2.1 Fire resistance

The member sizes and reinforcement covers required to provide fire resistance are shown in Table 17.

Table 17 Fire resistance and cover for beams

Fire resistance h	Minimum width, mm		Cover to main steel, mm	
	simply supported	continuous	simply supported	continuous
1	120	120	30	20
1½	150	120	40	35
2	200	150	50	50
3	240	200	70	60
4	280	240	80	70

If the width of the beam is more than the minimum in Table 17 the cover may be decreased as below:

Increase in width, mm	Decrease in cover, mm
25	5
50	10
100	15
150	15