2 General principles

This section outlines the general principles that apply to both initial and final design and states the design parameters that govern all design stages.

2.1 General

One engineer should be responsible for the overall design, including stability, and should ensure the compatibility of the design and details of parts and components even where some or all of the design and details of those parts and components are not made by the same engineer.

The structure should be so arranged that it can transmit dead, wind and imposed loads in a direct manner to the foundations. The general arrangement should ensure a robust and stable structure that will not collapse progressively under the effects of misuse or accidental damage to any one element.

2.2 Stability

Lateral stability in two orthogonal directions should be provided by a system of strongpoints within the structure so as to produce a 'braced' structure, i.e. one in which the columns will not be subject to sway moments. Strongpoints can generally be provided by the core walls enclosing the stairs, lifts and service ducts. Additional stiffness can be provided by shear walls formed from a gable end or from some other external or internal subdividing wall. The core and shear walls should preferably be distributed throughout the structure and so arranged that their combined shear centre is located approximately on the line of the resultant in plan of the applied overturning forces. Where this is not possible, the resulting twisting moments must be considered when calculating the load carried by each strongpoint. These walls should generally be of reinforced concrete not less than 180mm thick to facilitate concreting, but they may be of 215mm brickwork or 200mm solid blockwork properly tied and pinned to the framing for low- to medium-rise buildings.

Strongpoints should be effective throughout the full height of the building. If it is essential for strongpoints to be discontinuous at one level, provision must be made to transfer the forces to other vertical components.

It must be ensured that floors can act as horizontal diaphragms, particularly if precast units are used.

Where a structure is divided by expansion joints each part should be structurally independent and designed to be stable and robust without relying on the stability of adjacent sections.

2.3 Robustness

All members of the structure should be effectively tied together in the longitudinal, transverse and vertical directions.

A well-designed and well-detailed cast-in-situ structure will normally satisfy the detailed tying requirements set out in subsection 4.11.

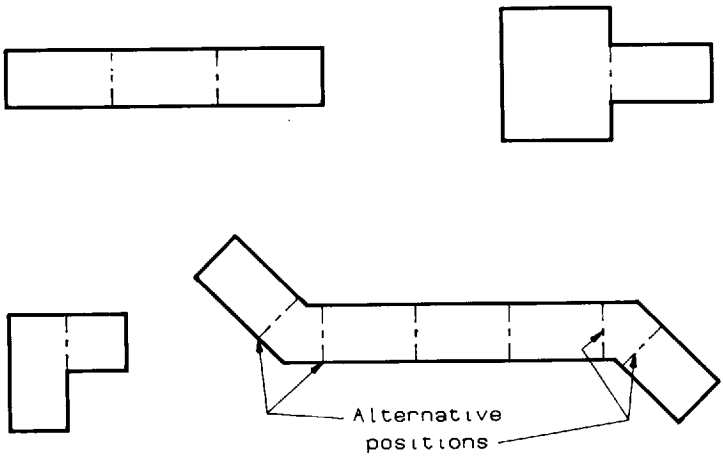
Elements whose failure would cause collapse of more than a limited part of the structure adjacent to them should be avoided. Where this is not possible, alternative load paths should be identified or the element in question strengthened.

2.4 Movement joints

Movement joints should be provided to minimize the effects of movements caused by, for example, shrinkage, temperature variations, creep and settlement.

The effectiveness of movement joints depends on their location. Movement joints should divide the structure into a number of individual sections, and should pass through the whole structure above ground level in one plane. The structure should be framed on both sides of the joint.

Some examples of positioning movement joints in plan are given in Fig. 1.



1 Location of movement joints

Movement joints may also be required where there is a significant change in the type of foundation or the height of the structure.

For reinforced concrete frame structures, movement joints at least 25mm wide should normally be provided at approximately 50m centres both longitudinally and transversely. In the top storey and for open buildings and exposed slabs additional joints should normally be provided to give approximately 25m spacing.

Attention should be drawn to the necessity of ensuring that joints are incorporated in the finishes and in the cladding at the movement joint locations.

2.5 Fire resistance and durability

In order for a structural member to be able to carry its load during and after a fire its size may need to be greater than that which is dictated by purely structural considerations. Similarly, the cover to reinforcement necessary to ensure durability may dictate the lower limit of the cross-sectional dimensions.

2.6 Loading

This *Manual* adopts the limit-state principle and the partial factor format of BS 8110. The loads to be used in calculations are therefore: