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Loadbearing masonry buildings

1.1 ADVANTAGES AND DEVELOPMENT OF LOADBEARING MASONRY

The basic advantage of masonry construction is that it is possible to use the same element to perform a variety of functions, which in a steelframed building, for example, have to be provided for separately, with consequent complication in detailed construction. Thus masonry may, simultaneously, provide structure, subdivision of space, thermal and acoustic insulation as well as fire and weather protection. As a material, it is relatively cheap but durable and produces external wall finishes of very acceptable appearance. Masonry construction is flexible in terms of building layout and can be constructed without very large capital expenditure on the part of the builder.

In the first half of the present century brick construction for multi-storey buildings was very largely displaced by steel- and reinforcedconcrete-framed structures, although these were very often clad in brick. One of the main reasons for this was that until around 1950 loadbearing walls were proportioned by purely empirical rules, which led to excessively thick walls that were wasteful of space and material and took a great deal of time to build. The situation changed in a number of countries after 1950 with the introduction of structural codes of practice which made it possible to calculate the necessary wall thickness and masonry strengths on a more rational basis. These codes of practice were based on research programmes and building experience, and, although initially limited in scope, provided a sufficient basis for the design of buildings of up to thirty storeys. A considerable amount of research and practical experience over the past 20 years has led to the improvement and refinement of the various structural codes. As a result, the structural design of masonry buildings is approaching a level similar to that applying to steel and concrete.

1.2 BASIC DESIGN CONSIDERATIONS

Loadbearing construction is most appropriately used for buildings in which the floor area is subdivided into a relatively large number of rooms of small to medium size and in which the floor plan is repeated on each storey throughout the height of the building. These considerations give ample opportunity for disposing loadbearing walls, which are continuous from foundation to roof level and, because of the moderate floor spans, are not called upon to carry unduly heavy concentrations of vertical load. The types of buildings which are compatible with these requirements include flats, hostels, hotels and other residential buildings.

The form and wall layout for a particular building will evolve from functional requirements and site conditions and will call for collaboration between engineer and architect. The arrangement chosen will not usually be critical from the structural point of view provided that a reasonable balance is allowed between walls oriented in the principal directions of the building so as to permit the development of adequate resistance to lateral forces in both of these directions. Very unsymmetrical arrangements should be avoided as these will give rise to torsional effects under lateral loading which will be difficult to calculate and which may produce undesirable stress distributions.

Stair wells, lift shafts and service ducts play an important part in deciding layout and are often of primary importance in providing lateral rigidity.

The great variety of possible wall arrangements in a masonry building makes it rather difficult to define distinct types of structure, but a rough classification might be made as follows:

- Cellular wall systems
- Simple or double cross-wall systems
- Complex arrangements.

A cellular arrangement is one in which both internal and external walls are loadbearing and in which these walls form a cellular pattern in plan. Figure 1.1 (a) shows an example of such a wall layout.

The second category includes simple cross-wall structures in which the main bearing walls are at right angles to the longitudinal axis of the building. The floor slabs span between the main cross-walls, and longitudinal stability is achieved by means of corridor walls, as shown in Fig. 1.1(b). This type of structure is suitable for a hostel or hotel building having a large number of identical rooms. The outer walls may be clad in non-loadbearing masonry or with other materials.

It will be observed that there is a limit to the depth of building which can be constructed on the cross-wall principle if the rooms are to have