CHAPTER 2

Stairs

A few technical terms generally used for the design of stairs are defined below:

1. **Baluster:** It is a vertical member supporting the handrail. The combined framework of handrail and baluster is known as balustrade.
2. **Flight:** It is a series of steps without any platform or landing or break in their direction.
3. **Tread:** It is an upper horizontal part of a step on which the foot is placed while ascending or descending a stairway.
4. **Step:** This is a portion of a stair which comprises the tread and riser. This permits ascending or descending from one floor to another.
5. **Riser:** This is a vertical member between two treads. This provides support to the tread.
6. **Rise:** This is the vertical distance between the upper faces of any two consecutive steps.
7. **Flier:** It is a straight step having a parallel width of tread.
8. **Landing:** This is a platform provided between two flights.
9. **Nosing:** This is the outer projecting edge of a tread. This is generally made round to give an appearance that is more pleasing and makes the stair easy to negotiate.
10. **Going:** This is the width of the tread between two successive risers. In other words it is the horizontal distance between the faces of two consecutive risers.
11. **Winders:** They are tapering steps used for changing the direction of a stair.
12. **String or Stringer:** This is a sloping member which supports the steps in a stair.
13. **Newel Post:** This is the vertical post placed at the top and bottom ends of flights supporting the handrails.
14. **Run:** This is total length of stairs in a horizontal plane, including landings.
15. **Soffit:** This is the underside of a stair.
16. **Header:** This is a horizontal structural member supporting stair stringers or landings.
17. **Carriage:** This is a rough timber supporting the steps of wooden stairs.
18. **Staircase:** It is the space or enclosure or room which contains the complete stairway.

REQUIREMENTS OF A GOOD STAIR

1. Stairs should be so located that they can be easily accessible from the different rooms of the building.
2. It should have provision for adequate light and proper ventilation.
3. It should have sufficient stair width to accommodate a number of persons in peak hours or emergencies. Generally, for interior stairs the clear width may be required to be at least 50 cm in one and two family dwellings, 90 cm in hotels, motels, apartment building and industrial buildings and 1.1 m for other types of occupancy.
4. The number of steps in a flight should generally be restricted to a maximum of 12 and minimum of 3.
5. Ample head room should be provided not only to prevent tall people from injuring their head, but also to give a feeling of spaciousness. Vertical clearance should never be less than 2.15 m.
6. Sizes of risers and treads should generally be proportioned from the comfort point of view. Treads should be 25–32.5 cm wide, exclusive of nosing. Treads less than 25 cm width should have a nosing of about 25 cm. The most comfortable height of the riser is 17.5–18.5 cm. Generally, the following formulae should be used:
7. Product of riser and tread must be between 400 and 410.
8. Riser plus tread must equal 42.5–43.5 cm.
9. Sum of the tread and twice the riser must lie between 60 and 64 cm.
10. Stair width depends upon the purpose and importance of the building. In the case of residential buildings, it should be kept as 1 m.
11. The number of stairways required should be controlled on the maximum floor area contributory to a stairway. The number of persons that may be served by stairs per floor per 55 cm unit of stair width should be 15 for such buildings as hospitals and nursing homes, 30 for other institutional and residential buildings, 45 for storage buildings, 60 for mercantile, business, educational, industrial buildings, theatre and restaurants, 80 for churches, concert halls and museums, and 320 for stadium and amusement structures.
12. The minimum width of landing should be equal to the width of the stairs.
13. The maximum and minimum pitch should be 40° and 25° respectively in any stairs.

14. Winders should be provided at the lower end of the flight, only when it is essential. Generally, the use of winders in a staircase should be avoided.
15. In open-well stairs in order to avoid the danger of accidents balustrade must be provided.
16. The live loads to be considered on stairs have been stipulated by IS:875-1964. The stairs and landings should be designed for a live load of 300 kg/m^2 in buildings where there are no possibilities of overcrowding. In the case of public buildings and warehouse, where overcrowding is likely, the live load may be taken as 500 kg/m^2.

TYPES OF STAIRS

Generally, stairs are of the following types (Figure 20.1):

1. Straight stairs
2. Quarter turn stairs
3. Half turn stairs
4. Three quarter turn stairs

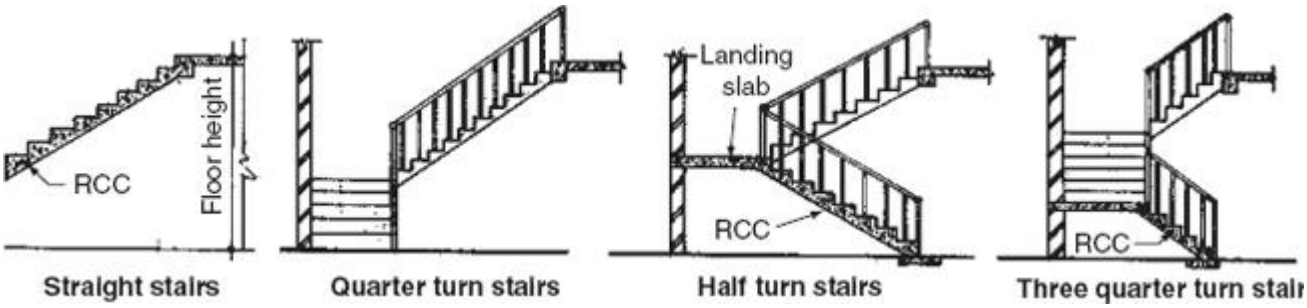


Figure 20.1 Different types of stairs

5. Circular stairs
6. Spiral stairs
7. Curved stairs
8. Geometrical stairs
9. Bifurcated stairs

1. Straight stairs

These are the stairs along which there is no change in direction on any flight between two successive floors. The straight stairs can be:

I. Straight run with a single flight between floors
II. Straight run with a series of flights without change in direction
III. Parallel stairs
IV. Angle stairs
V. Scissors stairs

Straight stairs can have a change in direction at an intermediate landing. In case of parallel stairs, the stairs require a complete reversal of direction. In case of angle stairs, the successive flights are at an angle to each other. Scissor stairs are comprised of a pair of straight runs in opposite directions and are placed on opposite sides of a fire-resistive wall.

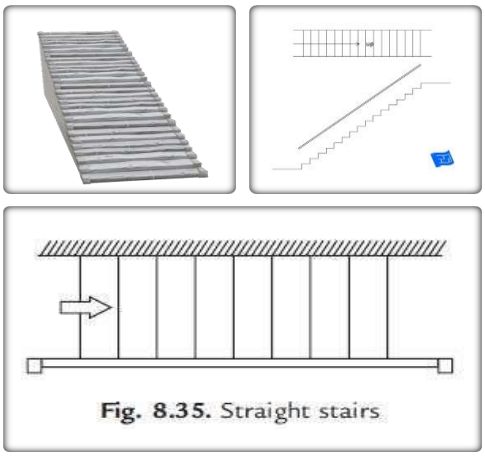
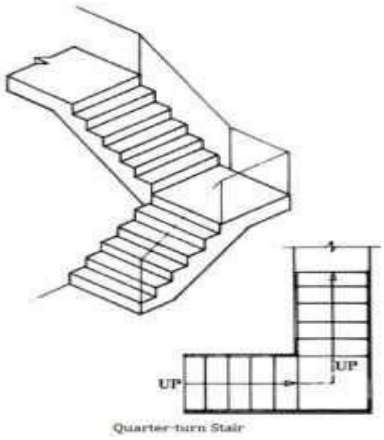


Fig. 8.35. Straight stairs



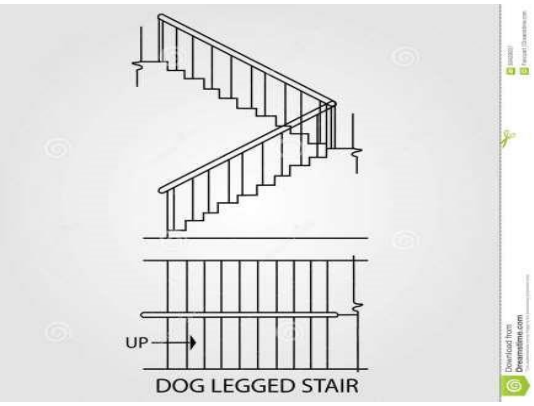
Quarter-turn Stair

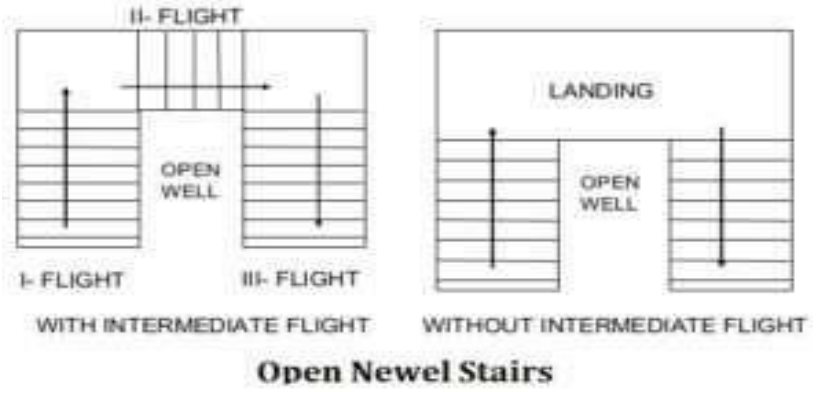
2. Quarter turn stairs

They are provided when the direction of flight is to be changed by 90°. The change in direction can be effected by either introducing a quarter-space landing or by providing winders at the junctions.

3. Half turn stairs

These stairs change their directions through 180°. It can be either 'dog-legged' or 'open newel type'. In case of dog-legged stairs, the flights are in opposite directions and no space is provided between the flights in plan. On the other hand, in open newel stairs, there is a well or opening between the flights and it may be used to accommodate a lift. These stairs are used at places where sufficient space is available.





4. Three quarter turn stairs

This type of stairs changes their directions through 270°. In other words, direction is changed three times with its upper flat crossing the bottom one. In this type of construction an open well is formed.

5. Circular stairs

These stairs, when viewed from above, appear to follow a circle with a single center of curvature and large radius. These stairs are generally provided at the rear of a building to give access for servicing at various floors. All the steps radiate from a newel post in the form of winders. These stairs can be constructed in stone, cast iron or RCC.

6. Spiral stairs

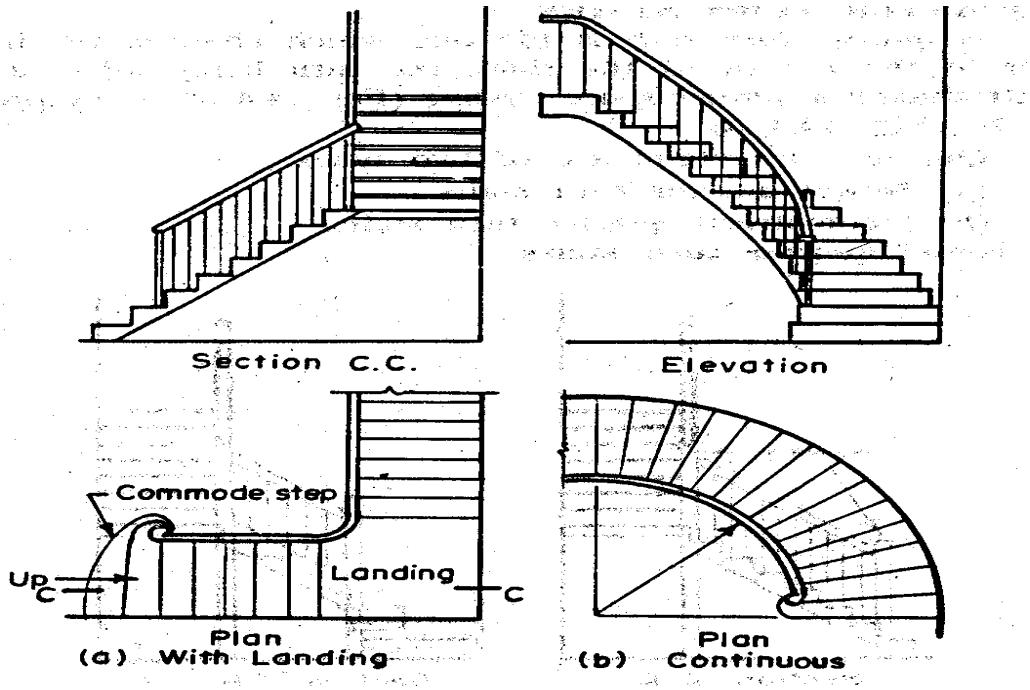
These stairs are similar to circular stairs except that the radius of curvature is small and the stairs may be supported by a center post. Overall diameter of such stairs may range from 1 to 2.5 m.

7. Curved stairs

These stairs, when viewed from above, appear to follow a curve with two or more centers of curvature, such as an ellipse.

8. Geometrical stairs

These stairs have no newel post and are of any geometrical shape. The change in direction in these stairs is achieved through winders. The stairs require more skill for its construction and are weaker than open newel stairs. In these stairs, the open well between the forward and the backward flights is curved.



9. Bifurcated stairs

These stairs are so arranged that there is a wide flight at the start which is subdivided into narrow flights at the mid-landing. The two narrow flights start from either side of the mid-landing. Generally, these stairs are more suitable for public buildings.

STAIRS OF DIFFERENT MATERIALS

The following materials are used in the construction of stairs:

a. Stone stairs

The stones employed in the construction of stairs are hard, durable, weather resistant and fire resistant. The stone steps can be either

i. Cantilevered from the wall
ii. Built into the wall at both ends

b. Brick stairs

They are rarely used except as entrance steps. A brick stair may be built of solid masonry work. The surface of the stair may be given any suitable type of floor finish.

c. Wooden stairs

Wooden stairs are light in weight and they are generally used for residential buildings. The greatest limitation of wooden stairs is that it catches fire easily, and in case of a fire, the occupants of upper floors will find no way of escape. If good quality of timber of proper thickness is used, it resists fire to a great extent and the occupants will have enough time to escape.

d. RCC stairs

These stairs are commonly used in all types of constructions. They can resist wear and fire better than any other material and can be casted to the desired shape. The advantages of the RCC stair are as follows:

i. It can resist fire in a better way.
ii. Movement over it produces less noise.
iii. It can be cast.