STAIRS
What is stairs?

• “A Stair is a system of steps by which people and objects may pass from one level of a building to another.”

• A stair is to be designed to span large vertical distance by dividing it into smaller vertical distances, called steps.
Location of Stairs

• It should be so located as to provide easy access to the occupants of the building.
• It should be so located that it is well lighted and ventilated directly from the exterior.
• It should be so located as to have approaches convenient and spacious.
• It public building it should be located near main entrance and in residential building it should be placed centrally.
Technical Terms
The definitions of technical terms used in connection with the stairs are as follows:

1) **Baluster** :-
   It is *vertical member* of wood or metal *supporting* the hand rail.

2) **Handrail** :-
   The *inclined rail* over the *string* is known as a handrail.

3) **Newel post** :-
   This is the *vertical member* which is placed at the *ends of flights* to connect hand rail.

4) **Soffit** :-
   It is the *underside* of a stair.

5) **Waist** :-
   The *thickness* of structural slab in case of an R.C.C. stair is known as a waist.
6) Nosing :-

   It is the **projecting part** of the tread beyond the face of the riser.

   It is rounded to give **good architectural effect**.

7) Scotia :-

   It is a **moulding provided under** the nosing to improve the elevation of the step.
8) **Step** :-

It is a portion of stair which permits ascent and descent.

It is comprised of a tread and riser.

9) **Tread** :-

It is the upper horizontal portion of a step upon which the feet is placed while ascending or descending.

10) **Rise** :-

It is the vertical distance between two successive tread faces.

11) **Going** :-

It is the horizontal distance between two successive riser faces.
12) Flight :-

A series of steps without any platform, break or landing in their direction.

13) Landing :-

It is the level platform at the top or bottom of a flight between the floors.

14) Run :-

It is the total length of stairs in a horizontal plane, including landings.
15) Headroom :-
   It is the minimum clear vertical distance between the tread and ceiling.

16) Pitch or Slope :-
   It is the angle which the line of nosing of the stair makes with the horizontal.

17) Riser :-
   It is the vertical portion of a step providing a support to the tread.

18) Line of nosing :-
   It is an imaginary line touching of each tread and is parallel to the slope of the stair.
19) Winders :-

These are tapering steps which are provided for changing the direction of a stair.

20) Strings or stringers :-

These are the sloping wooden members which support the steps in a stair. They run along the slope of the stair.

There are two types of string :

i) a cut or open string

ii) a closed or housed string

In the cut or open string, the upper edge is cut away to receive the ends of steps.

In the closed or housed string, the ends of steps are housed between straight parallel edges of the string.
21) Balustrade or Barrister :-

The combined framework of handrail and balusters is known as the balustrade or barrister.

22) Walking line :-

The approximate line of movement of people on a stair during ascending or descending is known as a walking line and it is situated at a distance of about 450 mm from the centre of handrail.
Types Of Steps..

Steps in a stair may be of following types:

1) Bullnose step
2) Round ended step
3) Filer
4) Splayed step Commode step
5) Dancing step or Balancing step
6) Splayed step
7) Winder
1) Bullnose step :-

   It is generally provided at the bottom of the flight, projecting in front of the newel post. Its end near the newel forms the quadrant of a circle.

2) Round ended step :-

   A round ended step is similar to a bullnose step except that it has a semi-circular end which projects out from the stringer.

3) Filer :-

   A filer is an ordinary step of uniform width and rectangular shape in plan.

Round ended step
4) Commode step :-

A commode step has curved tread and riser.

5) Dancing steps or Balancing step :-

Dancing steps are the winders which do not radiate from a common centre.
6) Splayed step :-
   This step has one end or both ends splayed in plan.

7) Winders :-
   Winders are tapering steps, such as those which radiate from a point usually situated at the centre of a newel post.
Types of Stairs

- Straight Stairs
- Circular Stairs
- Geometrical Stair
- Turning Stairs
STRAIGHT STAIRS

- All steps lead in one direction.
- Simplest form of stair arrangement.
- It may consist of one or more flights.
- They are used when space available for staircase is long but narrow in width.
• The width and the length of the landings should be equal.
Turning Stairs

1. Quarter Turn Stairs
2. Half-Turn Stairs
3. Three Quarter Turn Stairs
In case of turning stairs, flights take turn. The types of turning stairs are:

1. **Quarter turn stairs:**
   - A stair turning through one right angle is known as *Quarter turn stairs.* (L-shaped stair)
   - If a quarter turn stair is branched into two flights at a landing is known as a *Bifurcated stair.*
   - This type of stair is commonly used in the public buildings near the entrance hall.
   - The stair has a wider flight at bottom which bifurcates into two narrower flights at the landing.
-one turn into **left** and the other to the **right**.

- This staircase has **either equal or unequal flights**.
2. **Half Turn Stairs:**

- A stair turning through **right angle** is known as **Half Turn Stairs**.
- A half turn star may be of **dog-legged type** or **open newel type**.

**DOG-LEGGED STAIR**

- Two short flights with a half space landing between them.
- In case of dog-legged stair, the flights run in opposite directions and there is **no space** between them in plan.
• Its name is derived from its appearance in the sectional elevation.
• This stairs are useful where total width of space available for the staircase is equal to twice the width of steps.

**OPEN NEWEL STAIR**

• Space between the upper and lower flights causes half space landing to be longer.
• In case of open newel stair, there is a well or hole or opening between flights in plan.
• This well may be rectangular or of any geometrical shape and it can be used for fixing lift.
• These staircase are useful where available space for staircase has a width greater than twice the width of steps.
3. *Three quarter turn Stair*

- A stair turning through three right angles is known as a three quarter stair.
- In this case, an open well is formed. This types of stair is used when the length of the staircase is limited and when the vertical distance between the two floor is quite large.
Circular or helical or spiral stairs
• the steps radiate from the center and they do not have either any landing or any intermediate newel post.....

• Some of the important facts to be noted in connection with the circular stairs are:

1. flights consist of winders only and may be continued through any number of turns.
2. may be constructed of a cast iron or mild steel or concrete. Usually its structural design and construction of are complicated in nature.
3. For concrete spiral stairs, the steel reinforcement is heavy and formwork is complicated. These make the concrete spiral stairs expensive.

4. The core of spiral stair may be solid or hollow and the stair may be provided with cut or closed strings.

5. The spiral stairs are useful where the space available is limited and where the traffic is less. Eg., shops
Geometrical Stairs
“continuous stairs that turn or wind about a central well hole which has rounded corners or is circular or elliptical and that have the strings and rails arranged upon geometric principles and running continuously from top to bottom.”
• have any geometrical shape and requires no newel posts.

• The handrail continues without interruption and without any angular turns.

• Its construction requires considerable skill and it is weaker than corresponding open newel stair.
Stairs of diff. Materials

R.C.C. Stairs

Stone Stairs

Timber Stairs

Brick Stairs

Metal Stairs
BRICK STAIRS

• not frequently used.
• may be built of solid masonry construction or arches may be provided in a lower portion.
• When arches are provided, the total masonry work is reduced and cupboards may be provided in this hollow space.
• Treads are generally made equal to length 1.50 bricks and risers with the layers of 2 brick respectively.
• The treads and risers are finished with suitable flooring material.
The entrance stairs form a typical bricks stairs (as shown in fig.).
A brick stairs may be made of solid construction or arches may be provided (as shown in fig.).
Stone is placed above to give additional touch.
Built-up steps...stone is placed above to give additional touch
METAL STAIRS

• The external fire-escape stairs are generally made of metal.
• The common metals used are cast iron, bronze and mild steel.
• used only as emergency stairs.....not common in residential and public building.
• mostly used in factories, godowns, workshops etc.
The important features of metal stairs:

1. **Stringers** are usually of channel section.
2. Tread and riser of a step may be of one unit as shown in figure.
3. The tread and riser of a step may **be of separate units** as shown in fig.
Spiral Steel Stair

ELEVATION

PLAN
(4) The treads and risers are supported on the angles which are connected to the stringers.

(5) The risers may be totally omitted in some cases.

(6) The spiral stairs of cast-iron consist of a cast-iron newel fixed in the centre around which the cast-iron steps are fixed.

(7) For metal stairs the metal balusters with handrail of pipe are used.
Contemporary Metal Staircase Design
R.C.C. STAIRS

- commonly used in all type of constructions for residential, public, and industrial buildings, in case of framed structures, R.C.C. stairs is perhaps only choice.
- are very good fire resistance.
- can be easily moulded to the desired shape.
- steps can be provided with suitable finishing material such as marble, tile, etc.
- can be easily maintained clean and they are strong, durable and pleasing in appearance.
- can also be easily rendered non-slippery and can be designed for greater width and longer shapes.
A typical R.C.C. stairs is shown in fig.
Precast R.C.C. Stairs

• The detail and placing of reinforcement will naturally depend on the design of R.C.C. Stair.
• The steps may be cast-in-situ or pre-cast.
In the later case, it is also possible to pre-cast a flight and then place it in position with the help of suitable equipment.
• above mentioned materials (marble, tiles, etc.) can be used in combination with each other so as to formed what are known as “composite stairs”.

• The various components of stairs are made of different materials and in addition, the lightweight materials such as aluminium, plastic etc. May be employed to construct composite stairs.

• The stairs of public entertainment places such as theatres requires special treatment for finish.
WOODEN OR TIMBER STAIRS
• Cheap, light in weight, easy to construct & maintenance.....That’s why mostly used for residential buildings.
• Problem occurs during fire because occupants of upper floors cannot escape.......but if stair is constructed from good quality timber like oak, teak, mahogany, etc. using min. thickness of 5cm, to serve the requirements of a fire-resisting stair to a great extent.

The imp factors to be considered in case of a wooden stair are as follows:

1. The joints connecting risers & treads are nailed or screwed.
2. Stringers may be a cut/open string or close string.
3. Scotia blocks gives an additional finish to a wooden step if provided.
4. A metal strip may be provided on the nosing of a wooden step to increase its resistance against wear & tear.
5. Small triangular wooden blocks, known as *glue blocks*, may be provided at the inner angle formed b/w a tread & riser gives an additional touch, placed at abt 80mm distance.

6. In some cases, the risers may be totally omitted. The treads are housed in the strings & the soffit is covered with wooden battens or metal sheets.

Timber used ------

- free from fungal decay, insect attack & other defects.
- edges should be finished smooth.
- pieces of timber having abnormal light weight should not should not be used.
Contemporary Timber Staircase design
STONE STAIRS

• Stones should be hard & non-absorbent.
• Possess enough resistance to the action of fire.
• Mostly used for warehouses, workshops & other public buildings.
• Widely used where ashlar stones are easily available,
• Restricted in residential buildings to outside stairs. Being heavy in weight, stone stairs require stable support to avoid the danger of damage due to settlement of supporting walls.
Construction: A stone step may be constructed in any one of the following ways:

a) Rectangular step with rebated joint:
   • cut from solid stone into square or rectangular blocks of uniform size.
   • Arranged in a manner that the front edge of one step is resting on the upper back edge of the steps below.
     • the overlap is abt 25mm-40mm.
   • Results in considerable saving in labour of cutting and dressing stones.
b) Spandril step:

• Steps form triangular shape in cross-section.
• Cut in such a way to obtain a plain soffit.
• Used where the headroom is desired.
• Soffits afford a nice appearance & the weight of steps is also reduced.
• The ends built into the wall should be square so as to provide a horizontal seating.
• Soffit can also be made broken or moulded.
c) **Tread & Riser step:**
- The treads & risers are provided as in case of timber steps.
- The stone slab treads & risers are connected by dowels.

d) **Cantilever Tread Slab step:**
- Steps are **formed of treads only**, thick slabs are **used without any riser**.
- Steps may be **rectangular or triangular in shape**.
e) **Built-up step:**

- In the form of treads & risers of *thin sawn stone slabs*.
  - Placed over brick or concrete steps.
  - **Thickness** of the slab may vary from 20mm to 50mm.
- It is generally *adopted for marble steps* to give an ornamental covering to the step.
(ii) **Support & Fixing:** A stone step may be supported & fixed in any one of the following 4 ways:

a) Step may be supported & fixed **at both the ends in a wall.** The bearing in wall should be **at least 100mm for stairs upto 1.2m width & 200mm for width >1.2m.**

b) Steps may be supported **at one end only & the other end may be left unsupported.** Such a cantilevered step shouldn’t have length of more than **1.2m.**

c) Steps may be supported **at one end in a wall & at the other end, it may be supported by a steelwork.**

d) Steps may be supported **at both the ends on a steelwork.**
Spandril step with moulded soffit

Tread & riser step

Spandril step with broken soffit
Lets have Quiz!!

..identify the given stairs..
Glass Stairs

Cantilever Stairs

Straight Stairs
Geometrical Stairs

Circular Stairs
Staircases can be used in diff. ways too....
BAD STAIRS
THANK YOU

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