

Elements of Building Construction - II

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Doors and Windows

- A *door* may be defined as an openable barrier secured in a wall opening.
- A door is provided to give an access to the inside of a room of a building.
- It serves as a connecting link between the various internal portions of a building.
- Basically, a door consists of two parts : (i) door frame, and (ii) door shutter.
- The door shutter is held in position by the door frame which in turn is fixed in the opening of the wall by means of hold – fasts etc.,
- A *window* is also a vented barrier secured in a wall opening.
- The function of the window is to admit light and air to the building and to give a view to the outside.
- Windows must also provide insulation against heat loss, and in some cases, against sound.
- Some windows are also required to give a measure of resistant to fire.
- A window also consists of two parts : (i) Window frame, secured to the wall opening with the help of hold fasts, and (ii) Window shutters held in position by the window frame.



Door Frame

Door shutter



Hold fasts



Location of Doors and Windows

- The following points should be kept in view while locating doors and windows :
 1. The number of doors in a room should be kept minimum since larger number of doors cause obstruction, and consume more area in circulation.
 2. The location of a door should meet functional requirements of a room. It should not be located in the centre of the length of a wall. A door should preferably be located near the corner of a room – nearly 20 cm away from the corner.
 3. If there are two doors in a room, the doors should preferably be located in opposite walls, facing each other, so as to provide good ventilation and free – air circulation in the rooms.
 4. The size and number of windows should be decided on the basis of important factors such as distribution of light, control of ventilation, and privacy of the occupants.

5. The location of a window should also meet the functional requirements of the room, such as interior decoration, arrangement of furniture etc.
6. A window should be located in opposite wall, facing a door or another window, so that cross – ventilation is achieved.
7. From the point of view of fresh air, a window should be located on the northern side of a room.
8. From the point of fresh air, a window should be located in the prevalent direction of wind.
9. The sill of a window should be located about 70 to 80 cm about floor level of the room.

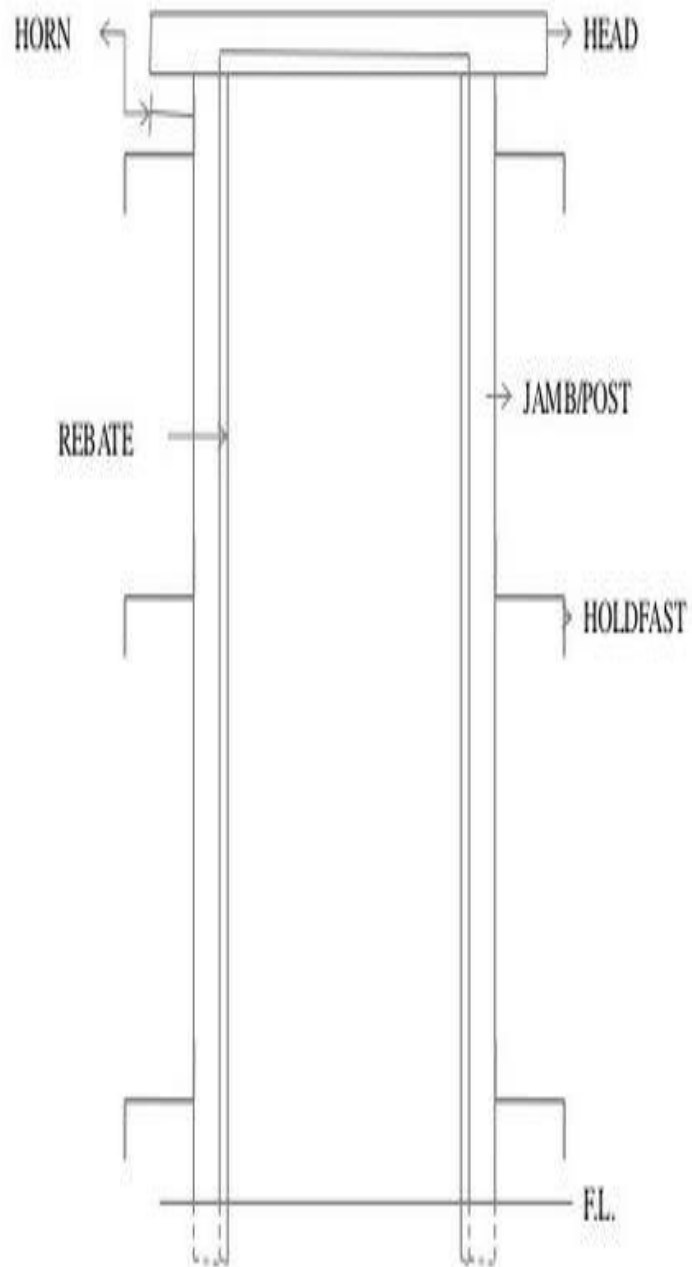


Definition of Technical Terms

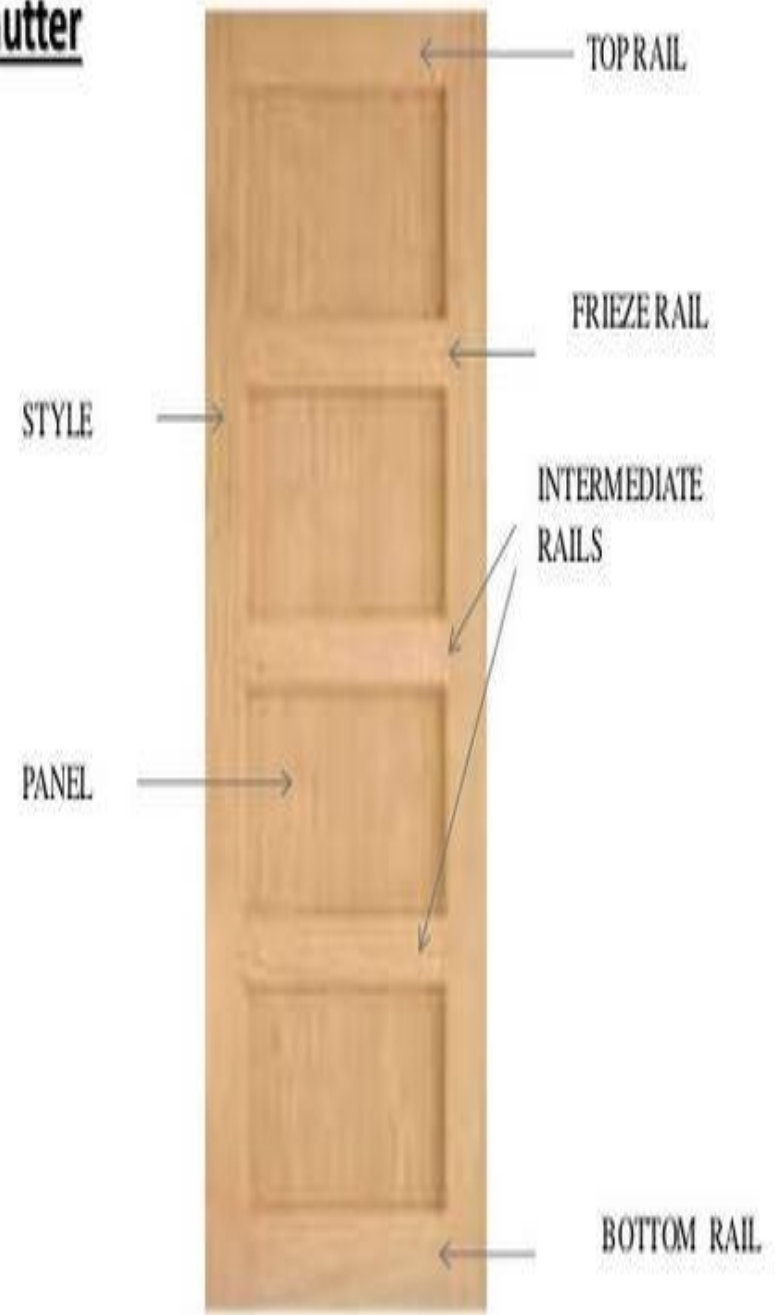
- **Frame** : It is an assembly of horizontal and vertical members, forming an enclosure, to which the shutters are fixed.
- **Shutters** : These are the openable parts of a door or window. It is an assembly of styles, panels and rails.
- **Head** : This is the top or uppermost horizontal part of a frame.
- **Sill** : This is the lowermost or bottom horizontal part of a window frame. Sills are normally not provided in door frames.
- **Horn** : These are the horizontal projections of the head and sill of a frame to facilitate the fixing of the frame on the wall opening. The length of horns is kept about 10 to 15 cm.
- **Style** : Style is the vertical outside member of the shutter of a door or window.
- **Top rail** : This is the top most horizontal member of a shutter.
- **Lock rail** : This is the middle horizontal member of a door shutter, to which locking arrangement is fixed.

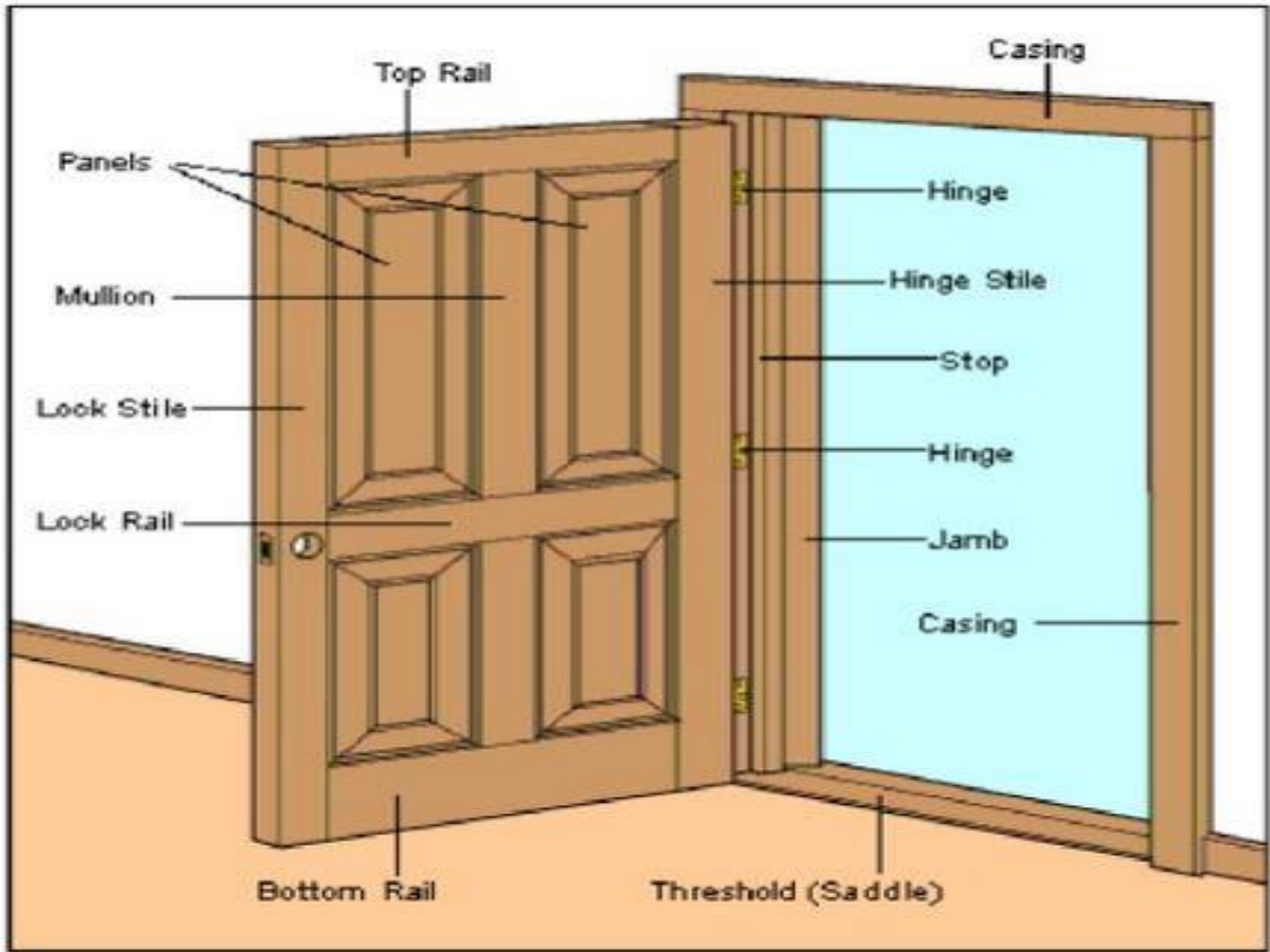
- ***Bottom rail*** : This is the lowermost horizontal member of a shutter.
- ***Intermediate or cross – rails*** : These are additional horizontal rails, fixed between the top and bottom rails of a shutter. A rail fixed between the top rail and lock rail is called frieze rail.
- ***Panel*** : This is the area of shutter enclosed between the adjacent rails.
- ***Mullion*** : This is a vertical member of a frame, which is employed to sub – divide a window or a door vertically.
- ***Transom*** : This is a horizontal member of a frame, which is employed to sub – divide a window opening horizontally.
- ***Hold fasts*** : These are mild steel flats (section 30 mm X 6 mm), generally bent into Z – shape, to fix or hold the frame to the opening. The horizontal length of hold fast is kept about 20 cm, and is embedded in the masonry.
- ***Jamb*** : This is the vertical wall face of an opening which supports the frame.

Door frame



Door shutter





Size of Doors

- The size of a door should be such that it would allow the movement of largest object or tallest person likely to use the door.
- The height of a door **should not be less than 1.8 m to 2 m.**
- The width of the door should be such that two persons can pass through it walking shoulder to shoulder.
- The common width – height relations, used in India are
 - (i) Width = 0.4 to 0.6 height
 - (ii) Height = (width + 1.2) metres

The following are the generally adopted sizes of doors for various types of buildings :

1. Doors of residential buildings

- (i) External door ----- (1.0 m X 2 m) to (1.1m X 2 m)
- (ii) Internal door -----(0.9 m X 2 m) to (1m X 2 m)
- (iii) Doors for bathrooms and water closets --- (0.7 m X 2 m) to (0.8m X 2m)
- (iv) Garrages for cars ----- 2.25 m (height) X 2.25 m (width) to 2.25m (height) X 2.40 m (width)

- **2. Public buildings, such as schools, hospitals, libraries etc.**
- (i) 1.2 m X 2 m (ii) 1.2 m X 2.1 m (iii) 1.2 m X 2.25 m
- IS recommends that the size of door frame should be derived after allowing a margin of 5 mm all – round an opening for convenience of fixing.
- The width and height of an opening is indicated by number of modules, where each module is of 100 mm.
- The height of opening is considered from below the floor finish to the ceiling of lintel.
- Eg : 8 DS 20, 10 DT 20
- D – Door opening
- S – Single Shutter
- T – Double shutters
- First number denote the width of door opening in modules
- Last number denote the height of opening in modules
- No.of modules X 100 mm = mm

Recommended Dimensions for Doors

Sr. No	Designation	Size of opening(mm)	Size of Door frames(mm)	Size of Door Shutter(mm)
1	8DS20	800 X 2000	790 X 1990	700 X 1905
2	8DS21	800 X 2100	790 X 2090	700 X 2005
3	9DS20	900 X 2000	890 X 1990	800 X 1905
4	9DS21	900 X 2100	890 X 2090	800 X 2005
5	10DT20	1000 X 2100	990 X 1990	900 X 1905
6	10DT21	1000 X 2100	990 X 2090	900 X 2005
7	12DT20	1200 X 2000	1190 X 2090	1000 X 1905

Size of Windows

- The selection of size, shape, location and number of windows in a room depends upon the following factors :
- (i) Size of the room (ii) Location of the room
- (iii) Utility of the room (iv) Direction of the wall
- (v) Direction of wind (vi) Climatic conditions such as humidity, temp etc.,
- (vii) Requirements of exterior view
- (viii) Architectural treatment to the exterior of the building
- Based on these factors, the following thumb rules are in use :
 1. Breadth of window = $(1/8)$ (width of room + height of room)
 2. The total area of window – openings should normally vary from 10 to 20% of the floor area of the room, depending upon climatic conditions.
 3. The area of window – opening should be at least one square metre for every 30 to 40 cubic metre of inside content of the room.
 4. In public buildings, the minimum area of windows should be 20% of floor area.
 5. For sufficient natural light, the area of glazed panels should at least be 8 to 10% of the floor area.

Size of Windows

❖ Recommended Dimension for windows

Sr.No.	Designation	Size of Opening (mm)	Size of Frame Window (mm)	Size of Window Shutter (mm)
1	6 WS 12	600×1200	590×1190	500×1100
2	10 WT 12	1000×1200	990×1190	460×1100
3	12 WT 12	1200×1200	1190×1190	560×1100
4	6 WS 13	600×1300	590×1290	500×1200
5	10 WT 13	1000×1300	990×1290	460×1200
6	12 WT 13	1200×1300	1190×1290	560×1200

- **WS = Window opening with single shutter**
- **WT = Window opening with double shutters**

DOOR FRAMES

Materials used for door frames

- Timber
- Steel
- Aluminium
- Concrete
- Stone

TYPES OF DOOR FRAMES

1- Wooden Door Frames



3- Iron Door frame



2. Aluminum Doorframe



4. Hollow PVC door frame



□ 5 UPVC door frames



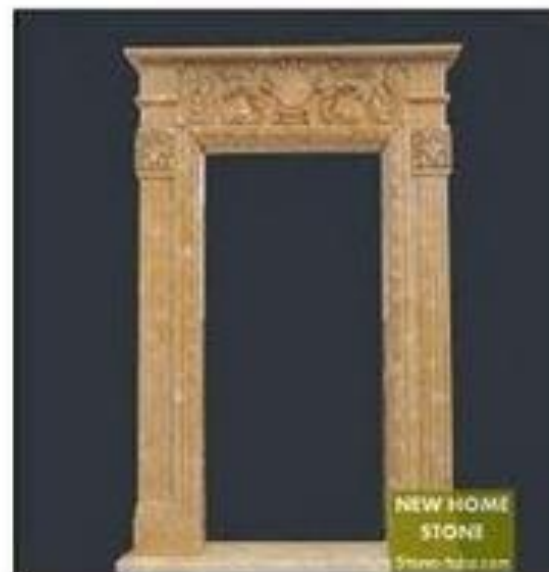
□ 7. Cemented door frames



•6. Extruded WPC door Frames



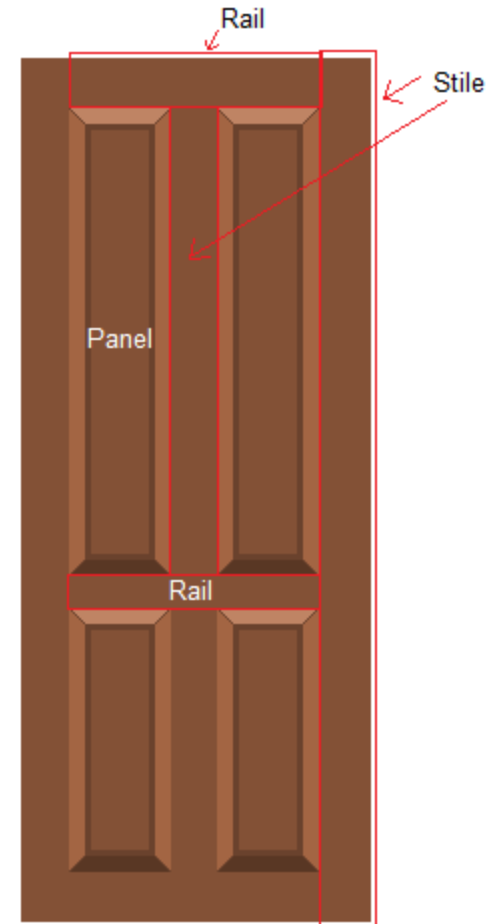
8. Stone door frames

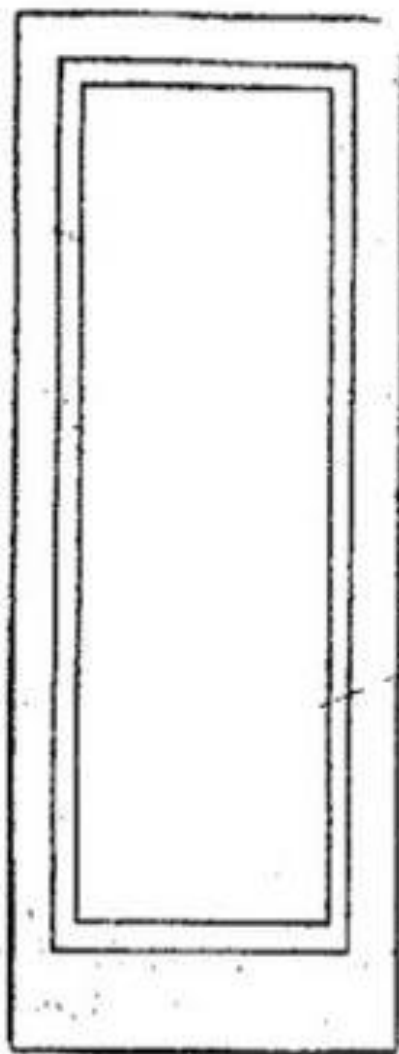


Types of Doors

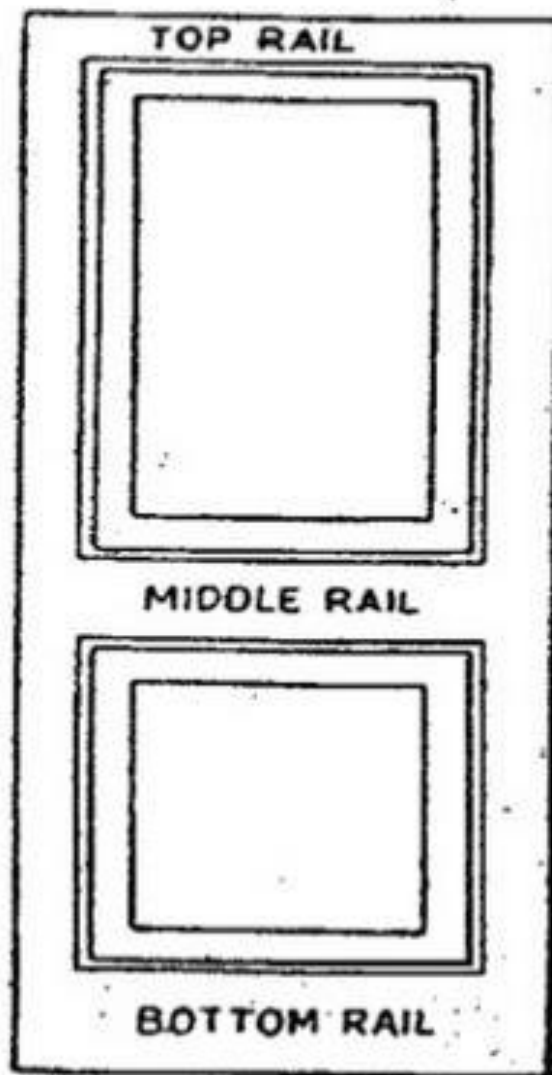
Framed and Paneled door

- These types of doors are widely used in all types of buildings since they are strong and give better appearance than battened doors.
- Panel doors consist of vertical members called stiles and horizontal members called rails.
- Stiles and rails form the framework into which panels are inserted.

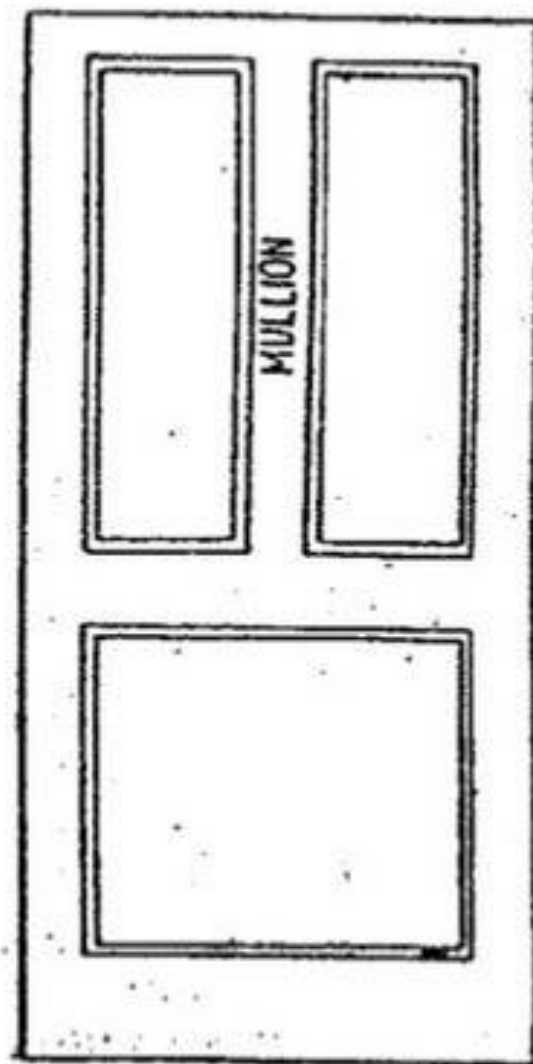




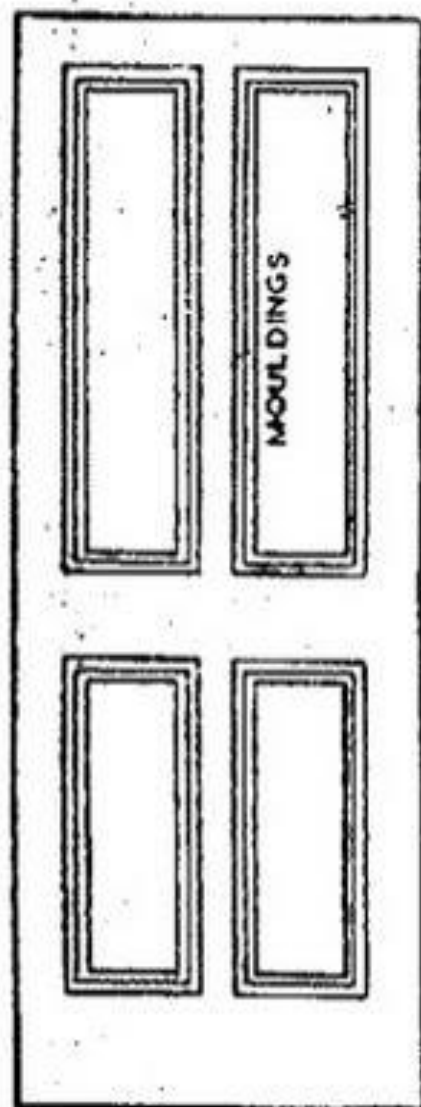
ONE PANNEL



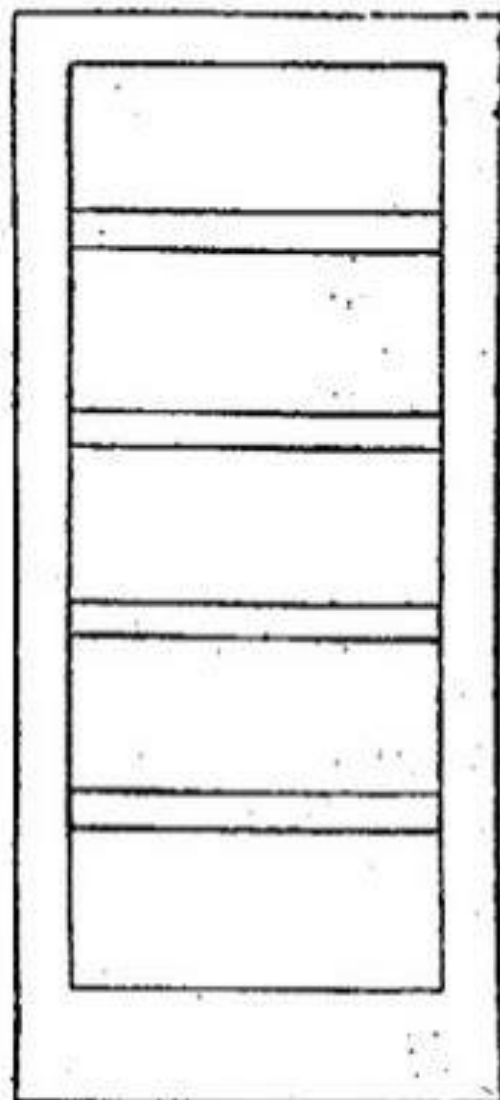
TWO PANNEL



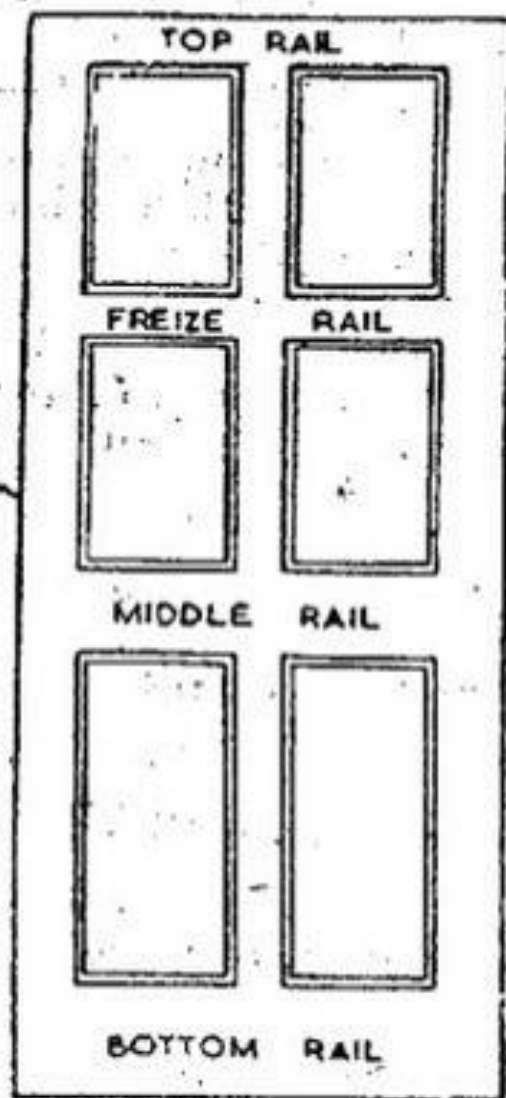
THREE PANNEL



FOUR PANNEL



FIVE PANNEL



SIX PANNEL

❖ Flush Doors

- The flush door with a framed core is a type of door that we frequently make in Rural Building. This door consists of a frame which has stiles, top and bottom rails, and narrow intermediate rails. It is covered on each side by a sheet of plywood Plywood-covered flush doors cannot be used where they will be exposed to rain and sun.



❖ Collapsible Door

- Such doors are used in garages, workshops, public buildings etc. to provide increased safety and protection to property.
- The doors do not require hinges to close or open the shutter nor the frame to hang them.
- It acts like a steel curtain.
- The door is made up from vertical double channels (20x10x2 mm), jointed together with the hollows on the inside to create a vertical gap.
- These channels are spaced at 100-120 mm apart and braced with diagonal iron flats.
- These diagonals allow the shutter to open or closed.
- The shutter operate between two rails, one fixed to the floor and other to the lintel.
- Rollers are mounted at the top and bottom.



❖ Rolling shutter

- These are commonly used for shops, godowns, stores etc.
- The door shutter acts like a curtain and thus provides adequate protection and safety against fire and thefts.
- The shutter is made up of thin steel slabs called laths or slates about 1.25 mm thick interlocked to each other and coiled upon specially designed pipe shaft called drum mounted at the top.
- The shutter moves in two vertical steel guide channels installed at their ends.
- The channel is made up of steel sheets and deep enough to accommodate the shutter and to keep it in position.
- A horizontal shaft and spring in the drum which allow the shutter to coiled in or out.
- These may be manually operated for smaller openings (upto 10 sq.m.).
- Above 10 sq. m., they may be operated manually.



PVC Doors

- **PVC**, or **polyvinyl chloride**, is an excellent material choice for **doors** in your bathroom.
- These modern, man-made **doors** help minimize your work while maximizing your investment.
- **PVC doors** look like painted wooden **doors**, but without the maintenance required for the absorbent, natural fibres of wood.



WB- 2005



WB- 2006



WB- 2007



WB- 2008



WB- 2009



WB- 2010



WB- 2011



WB- 2012

Type of Windows

❖ Glazed window

- This is a type of casement window where panels are fully glazed.
- The frame has styles, top rail and a bottom rail.
- The space between top and bottom rail is divided into number of panels with small timber members called, sash bars or glazing bars.
- The glass panels are cut 1.5-3.0 mm smaller in size than the panel size to permit movement of sash bars.
- Glass panes are fixed to sash bars by putty or by timber beads.



❖ Bay window

- The window projecting outward from the external walls .
- Wide and decoratively impressive allow for 180° view.
- A multi-panel window, with at least three panels set at different angles to create an extension from the wall line.
- it is commonly used in cold country where snow often falls.
- They may be triangular, circular, rectangular or polygonal in plan.



French Window

- In this type of windows, each of a pair of glazed doors in an outside wall, serving as a window and door, typically opening on to a garden or balcony.
- The pair of casement windows that reaches to the floor, opens in the middle, and is placed in an external wall.



- Ventilator: It is a narrow window of small height fitted near the roof of a room for ventilation. The construction is similar to the fanlights. They are horizontally pivoted.



STAIRS



INTRODUCTION

- Stairs is a set of steps which give access from floor to floor.
- The room or enclosure of the building, in which stair is located is known as staircase.
- Staircase provide access & communication between floors in multi-storey buildings and are a path by which fire can spread from one floor to another.
- Therefore it must be enclosed by fire resisting walls, floors, ceilings and doors.
- It must be designed to carry certain loads, which are similar to those used for design of the floors.
- Stairs may be constructed of Timber, Bricks, Stone, Steel or Reinforced Cement Concrete.




TECHNICAL TERMS

- **STEP:-** It is a portion of stair which permits ascent or descent. A stair is composed of a set of steps.
- **TREAD:-** It is a upper horizontal portion of a step upon which foot is placed while ascending or descending.
- **RISER:-** It is a vertical portion of a step providing support to the tread.
- **LANDING:-** It is level platform at the top or bottom of a flight between the floors.
- **FLIGHT:-** This is an unbroken series of steps between landing.

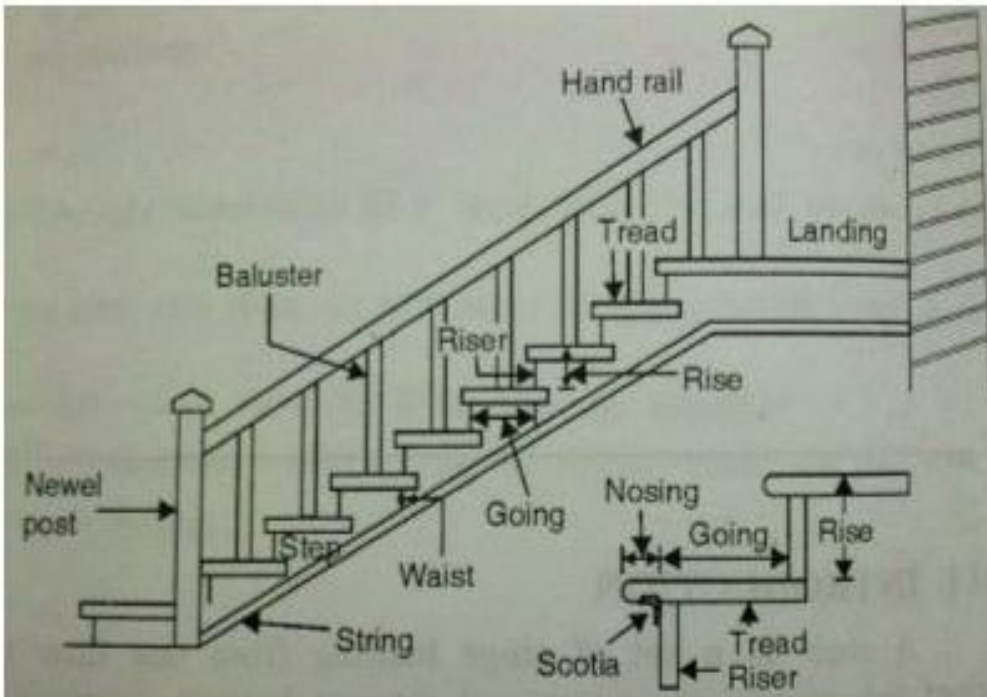


TECHNICAL TERMS

- **RISE:-** It is a vertical distance between two successive tread faces.
 - **GOING:-** It is a horizontal distance between two successive riser faces.
 - **NOSING:-** It is the projecting part of the tread beyond the face of riser.
 - **SCOTIA:-** It is a moulding provided under the nosing to provide strength to nosing.
 - **SOFFIT:-** it is the underside of a stair.
 - **PITCH OR SLOPE:-** It is the angle which the line of nosing of the stair makes with the horizontal.
- 

TECHNICAL TERMS

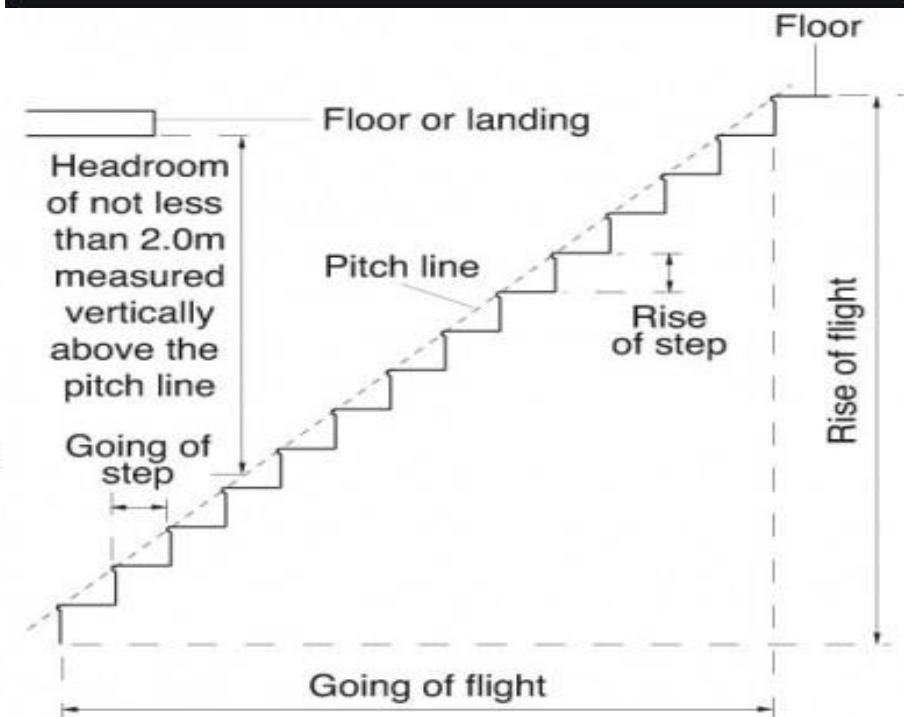
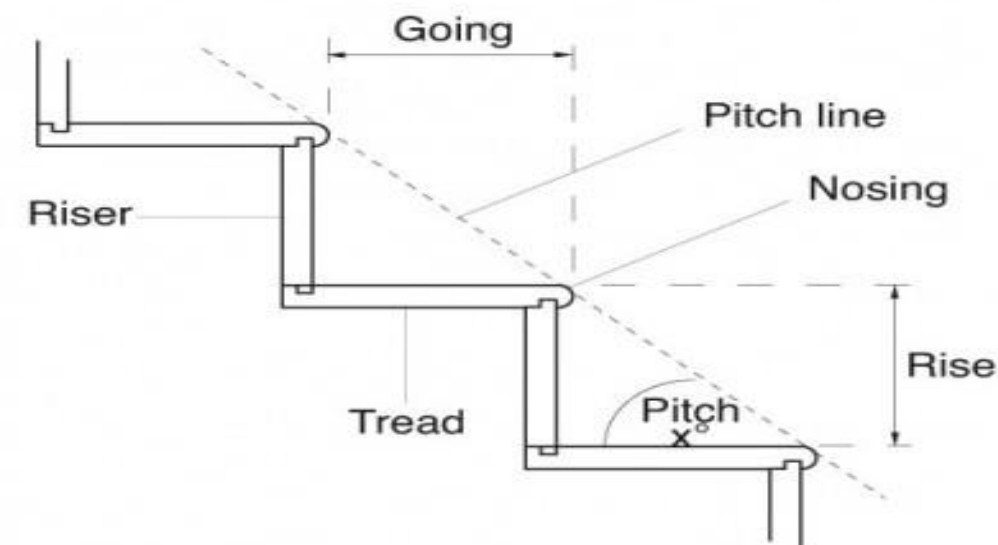
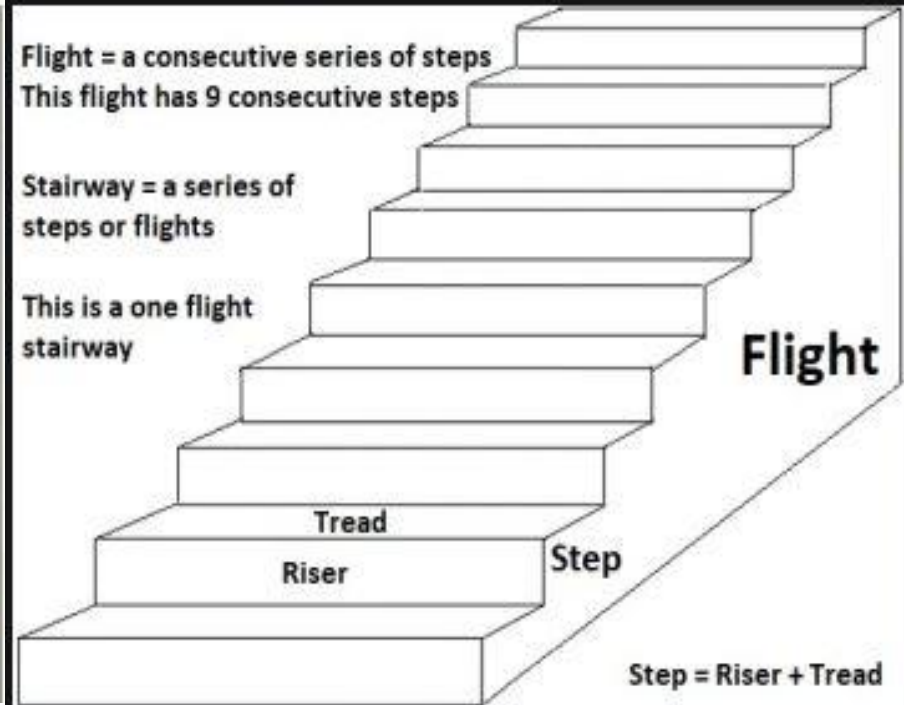
- **STRINGS OR STRINGERS:-** These are the slopping members which support the steps in a stair.
 - **NEWEL POST:-** Newel post is a vertical member which is placed at the ends of flight to connects the ends of strings and hand rail.
 - **BALUSTER:-** It is vertical member of wood or metal, supporting the hand rail.
 - **HEAD ROOM:-** It is the clear vertical distance between the tread and overload structure.
-
- **Balustrade :** It consists of a row of balusters surmounted by a hand rail, to provide protection for the users of the stairs.
 - **Hand Rail :** It is a rounded or moulded member of wood or metal following generally the contour of the nosing line, and fixed on the top of balusters.
 - **Run :** It is the total length of stairs in a horizontal plane, including landings.
 - **Header :** It is the horizontal structural member supporting stair stringers or landings.



Flight = a consecutive series of steps
 This flight has 9 consecutive steps

Stairway = a series of steps or flights

This is a one flight stairway



REQUIREMENTS OF GOOD STAIRCASE

○ LOCATION

- (a) They should be located near the main entrance to the building.
- (b) There should be easy access from all the rooms without disturbing the privacy of the rooms.
- (c) There should be spacious approach.
- (d) Good light and ventilation should be available.



REQUIREMENTS OF GOOD STAIRCASE

◦ WIDTH OF STAIR

- (a) It should be wide enough to carry the user without much crowd or inconvenience.
- (b) In Residential building, a 90 cm wide stair is sufficient while in public 1.5 to 1.8 m width may be required.

◦ LENGTH OF FLIGHT

- (a) The number of steps should not be more than 12 & less than 3 from comfort point of view.



REQUIREMENTS OF GOOD STAIRCASE

○ PITCH OF STAIR

- (a) Pitch should be limited to 30° to 45° .

○ HEAD ROOM

- (a) Height of head room should not be less than 2.1 to 2.3 m.

○ BALUSTRADE

- (a) Stair should always provided with balustrade.



REQUIREMENTS OF GOOD STAIRCASE

◦ STEP DIMENSION

- (a) The rise and going should be of such dimensions as to provide comfort to users.
- (b) The going should not be less than 25 cm, though 30 cm going is quite comfortable.
- (c) The rise should be between 10 to 15 cm.
- (d) The width of landing should not be less than width of stair.

◦ MATERIAL OF CONSTRUCTION

- (a) The material should have fire resistance and sufficient strong.



THUMB RULES FOR DIMENSIONS OF STEP

- (a) $(2 \times \text{Rise in cm}) + (\text{Going in cm}) = 60$
- (b) $(\text{Rise in cm}) + (\text{Going in cm}) = 40 \text{ to } 45$
- (c) $(\text{Rise in cm}) \times (\text{Going in cm}) = 400 \text{ to } 450$

TYPES OF STEPS

- **01. Flier:** Flier is an ordinary step of uniform width and rectangular shape as shown in figure.

- (a) Flier
- (b) Bull Nose
- (c) Round Ended
- (d) Splayed
- (e) Commode
- (f) Dancing
- (g) Winders



02. Bullnose Step: Bullnose step is generally provided at the bottom of the flight. It usually projects in front of the newel post and it ends near the newel forming the quadrant of a circle as shown in figure.



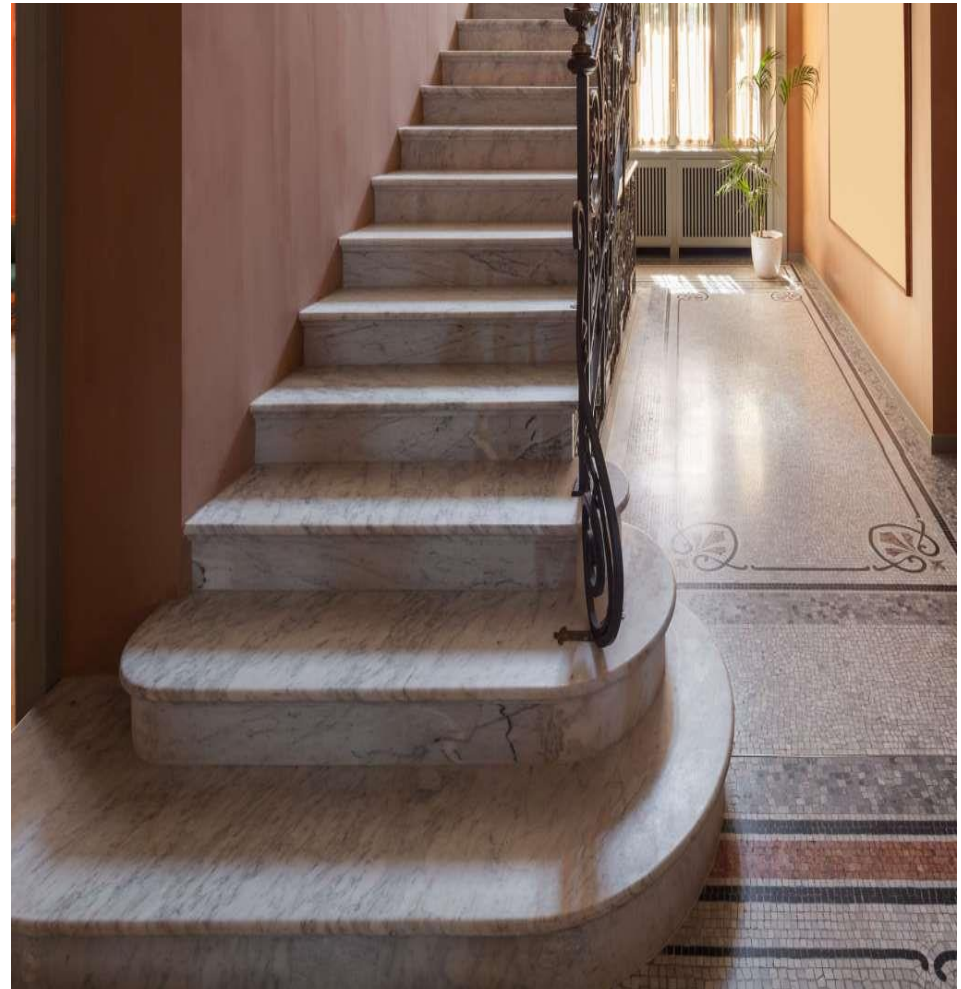
- **03. Round ended Step:** Round ended step is similar to the bullnose step the only difference is it has semi-circular end which project out of the stringer as shown in figure.



- **04. Splayed Step:** Splayed step is also provided at the beginning of the flight with its end near the newel post as shown in figure.



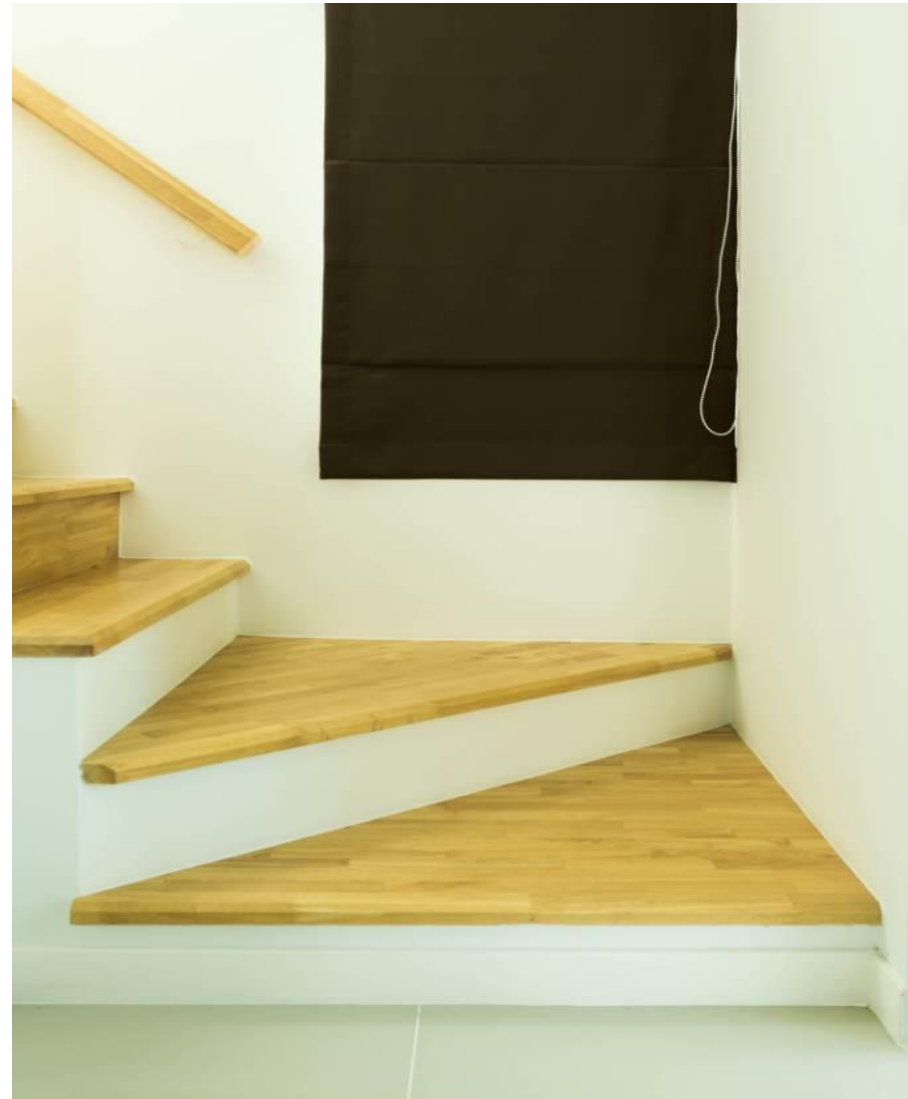
05. Commode Step: Commode step is also provided at the beginning of the flight, it has curved tread and riser as shown in figure.



- **06. Dancing Step or Balancing Step:** Dancing or Balancing steps are those which do not radiate from a common centre as shown in figure.



07. Winder: Winders are tapering steps which radiates from a point usually situated at the centre of newel as shown in figure.



CLASSIFICATION OF STAIRCASE

- Straight Staircase
- Turning Staircase
 - (a) Quarter Turn
 - (b) Half Turn (Dog-Legged & Open well Staircase)
 - (c) Three-Quarter Turn Staircase
- (d) Bifurcated Staircase
- Continuous Staircase
 - (a) Circular Staircase
 - (b) Spiral Staircase
 - (c) Helical Staircase



STRAIGHT STAIRCASE



QUARTER TURN STAIRCASE



DOG-LEGGED STAIRCASE



OPEN WELL OR NEWEL STAIRCASE

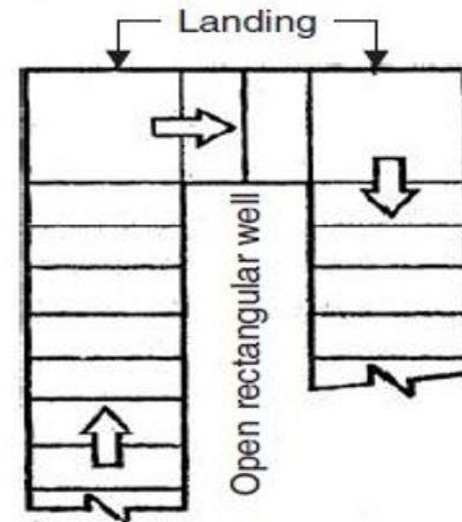


DOG-LEGGED STAIRCASE

- It consists of two straight flights with 180° turn between the two.
- They are very commonly used to give access from floor to floor.

OPEN WELL OR NEWEL STAIRCASE

- It differs from dog legged stairs such that in this case there is 0.15 m to 1.0 m gap between the two adjacent flights.



**GEOMETRICAL
STAIRCASE**



BIFURCATED STAIRCASE



BIFURCATED STAIRCASE



SPIRAL STAIRCASE



Materials Used in construction of Staircase

- Timber

- Metal

- R.C.C.

- Stone

- Glass

TIMBER STAIRCASE



METAL STAIRCASE



R.C.C. STAIRCASE



STONE STAIRCASE



GLASS STAIRCASE



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THANK YOU