

CONSTRUCTION TECHNOLOGY & MANAGEMENT



Presented By:

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Lecture Details:

Unit-V Topic: Concreting Equipments

CONTENTS

- ✓ Introduction
- ✓ Earth compaction equipment
- ✓ Hauling equipment
- ✓ Dump Trucks
- ✓ CRANES
- ✓ Compaction Equipment
- ✓ Aggregate production equipment

Earth compaction equipment

- Smooth-wheel rollers.
- Sheep-foot rollers
- Pneumatic-tyred rollers

Smooth-wheel rollers

- Plain steel rollers
- Weighing from 5 to 15 tonnes
- Used for ordinary rolling work where deep compaction is not required
- These rollers may have one front and two rear wheels
- The rear wheels being usually larger in diameter and the front one being winder.
- Weight of rollers may be increased by filling water or sand ballast in hollow cylinder.
- These rollers are effective in compacting granular soils, such as sand, gravel and crushed stone.

Sheep-foot rollers

For compacting earthwork in embankments and canals (where compaction deep into the layer of the earth is required)

- These gives best result in compaction when the soil is clay or predominantly cohesive and impervious.
- The sheep foot rollers may weigh upto 15 tonnes or more
- Travel at a speed of 25 kmph
- As roller moves over the surface, the feet penetrate the soil to produce a kneading action and a pressure to mix and compact the soil from bottom to top layer.
- With repeated passages of the roller, the penetration of feet decreases.



Smooth-wheel rollers



Sheep-foot rollers

Pneumatic-tyred rollers

- It consists a base or a platform mounted between two axles.
- The rear of which has one more wheel than the front.
- Most suitable for compacting fine-grained soil and well graded sands.
- Ballasting is done using either water, sand or pig iron in order to increase the self weight.
- Major advantages are the ability to control the ground contact pressure by:
 - a) Altering the weights of machines,
 - b) Increasing the number of wheels,
 - c) Increasing the tyre width
 - d) Changing the contact area of the tyre by altering the contact pressure.



Pneumatic-tyred rollers

Hauling equipment



- The equipment used for transportation of material are known as hauling equipment or simply haulers.
- Haulers may operate on the roadways or railways
- It involve
 - transportation of building materials,
 - carriage and disposal of excavated earth
 - haulage of heavy construction equipment.
- These are classified on the basis of method of dumping the load
 1. Dump trucks
 - a) Side or rear dump trucks
 - b) Bottom dump trucks
 2. Dumpers

Dump trucks

- These are used for earth moving purpose.
 - The selection of the type of dump trucks for a specific job depend on the soil condition.
- (a) Side or rear dump trucks-
- These are heavy duty trucks with strongly built body which is hinged on the truck chassis at the rear end and one side respectively, and can be fitted to the rear in the case of rear dump and to the hinged side in case of the side dump, through the action of hydraulic jacks.
 - These trucks are suitable for use in hauling wet clay, sand, gravel, quarry rocks etc.



Side dump truck



Rear dump truck

Bottom dump trucks

- These are similar to semi-trailers in which their front is supported on the rear of the hauling tractor and their rear is resting on their own wheels.
- The body of the truck remains in the same position and the discharge of the material takes place through its bottom after opening of two longitudinal gates.
- The gates are hinged to the side of the body.
- These trucks are suitable for use in hauling free flowing material, such as, sand, gravel, dry earth, hard clay etc.



Dumpers

- High speed pneumatic wheeled trucks
- Short chasis
- Strong bodies
- Loading, hauling and dumping is done very fast as compared to other equipment
- Suitable for short hauls on rough roads
- Specially where a shuttle movement is required.



Hoisting equipment

- Hoisting is the lifting a weight from one location and moving it to another location which is at a reasonable distance.
- Big projects such as, construction of dams, industrial buildings etc. require hoisting equipment.
- Hoisting equipment includes jacks, winches, chain hoists and cranes.
- Crane is the only single machine which, as a single piece, is capable of providing three-dimensional movement of a weight.

- Cranes are broadly classified as :
 - i. Stationary or derrick cranes
 - ii. Mobile cranes
 - iii. Overhead or gantry cranes
 - iv. Traveller cranes
 - v. Tower cranes

Derrick cranes

Derrick cranes consist of a mast, a boom and a bull wheel on which the boom rotates about a vertical axis and or supporting members.

- Electrically operated, diesel operated or diesel-electrically operated.
- The boom can revolve through 360°.
- This crane is used for heavy loads upto 200 tons.

Mobile cranes

- These cranes are mounted on mobile units which is either crawler type or wheel type
- Truck cranes have high mobility while the crawler mounted cranes move slowly.
- Crawler mounted cranes are capable of moving on rough terrain.

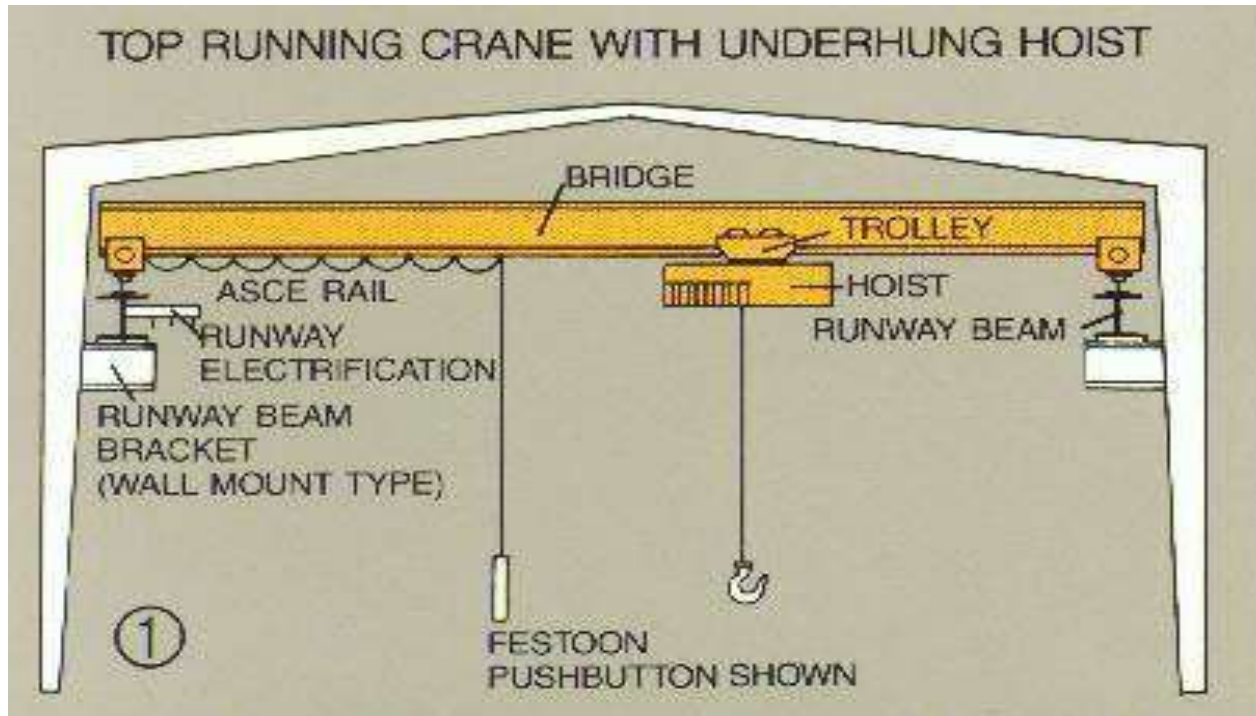
MOBILE CRANES



Overhead or gantry cranes

- large service area,
- freedom from floor obstructions
- and three-way mobility,
- Widely used in erection, foundry, steel plants, storage yards and different types of industrial works.
- These type of cranes consist of two main parts i.e., the bridge and the crab.
- The bridge consists of two main girders fixed at their end to end and capable of moving on gantry rails.
- The crab consists of the hoisting gear mounted on a frame.
- The frame itself is mounted on another set of wheels and capable of travelling across the main girder.

Overhead crane



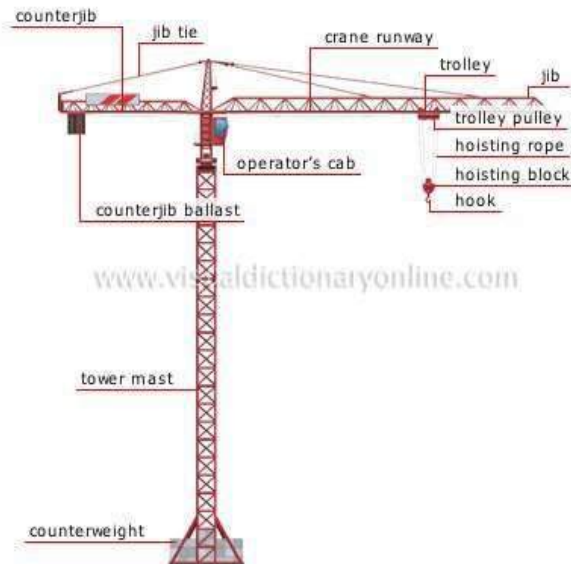
TRAVELLER CRANES

- Travelling or bridge cranes have their crabs moving on girders which are supported on legs instead of on overhead gantry track as used in overhead cranes.
- The legs are capable of moving on tracks laid on the floor.

Tower cranes

- Tower cranes are actually a derrick crane mounted on a steel tower.
- Tower cranes are usually used for industrial and residential high-rise buildings.
- These are commonly used for assembly of industrial plants with steel structures.
- The main parts of tower crane are under carriage, slewing platform, tower with operator's cabin and jibs.
- The tower has a truss structure welded from steel bars and channels.

Tower crane



Conveying equipment

- Transporting material from one place to another over a stationary structure.
- Carries material in continuous stream with its distinct feature such as endless chain or belt.
- Can be done horizontally, vertically or inclined.
- When the equipment does horizontal conveying, it is known as conveyor and when it does vertical, it is known as elevator.
- Conveying are mainly used in mining, construction and in some of the industries.
- In construction industry, conveyors are mainly used for concreting purpose.

Utility

The Advantage of using conveyors are as follows:-

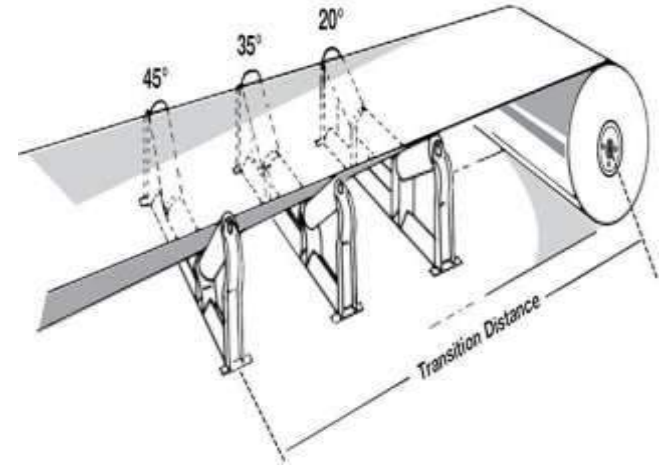
1. It increases the output.
2. It facilitates continuity in operation.
3. It results in time saving.
4. There are no waiting periods.

Some of the popular conveyors are as follows:-

1. Belt conveyor
2. Screw conveyor
3. Bucket conveyor
4. Aerial transport

Belt conveyor

- Used when large quantities of materials have to be conveyed over long distances at fast speed.
- It consists of a belt running over a pair of end drums or pulleys and supported at regular intervals by a series of rollers called idlers.
- These idlers are supported on a conveyor frame.
- The middle sag provided in the belt prevent the spilling of material.
- Generally, rubber is most commonly used as conveyor belt.



The advantages of using belt conveyor are as follows:-

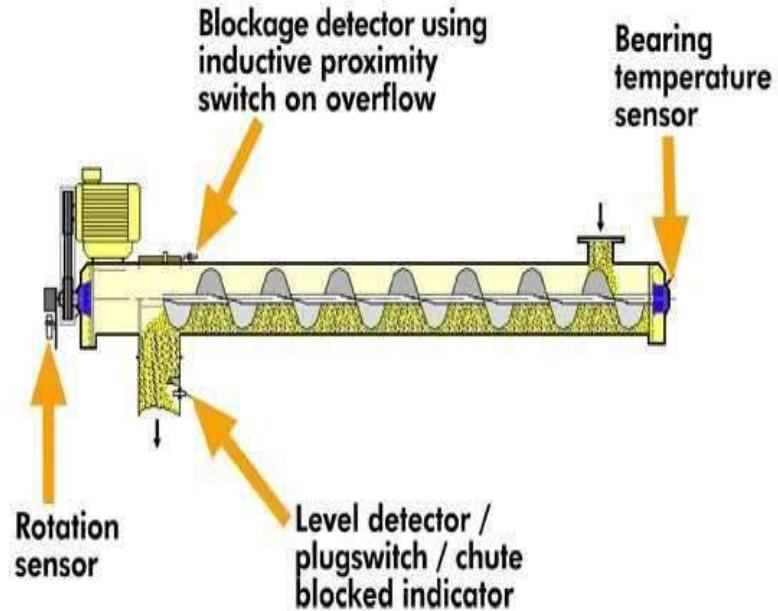
1. It can handle light as well as heavy materials, dry or wet, fine or coarse etc.
2. It can and for distances to convey several thousand tons of material per hour and for distances of distances of several kilometers.
3. It can carry material horizontally or inclined.
4. It is lighter in weight then other conveyors.
5. It gives controlled discharge of material and discharge can be controlled by the speed of the belt.

SCREW CONVEYOR

- Widely used for handling granular or pulverized material.
- The quantity of material conveyed is less compared to the conveyor, but at the same time the cost is also less.
- A screw conveyor consists of a helix mounted on a bearing at the ends and at intermediate points and is driven by a motor from one end.
- The material enters the through at one end is carried to the other end by screwing action of helix.
- The length of the conveyor is about 65m. with an inclination up to a maximum of 35°.

Bucket conveyor

- It has buckets in the shape of 'V' which are open at the top.
- They may be feeder loaded or may drag in a vertical movement or along an incline.
- The length of these type of conveyors are generally limited to 25 m. (due to weight of the conveyor and strength of the chains.)
- This type of conveyor is mainly used in coal handling where bucket elevators carry the material vertically.



SCREW CONVEYOR



Bucket conveyor

Aerial transport

- Aerial transportation through cableways, rope-ways and tram ways
- Often used with advantage for transportation of material in hilly regions.
- Reducing the distance of transportation as well as cost of transportation
- The load being passed over intermediate towers or stations for long distances.



Aggregate and concrete production equipment

- Aggregate has to be produced at the site, if the quantity needed is very large.
- Therefore, in any project where concrete requirement is very high, an aggregate preparation and processing plant is essential to complete the concreting operations.
- Aggregate production consists of two stages is recovery and processing.
- Basic material, such as stone, is recovered from a rock quarry or from the river bed and processing is done which consists of crushing, grading, washing and stock piling of aggregate.

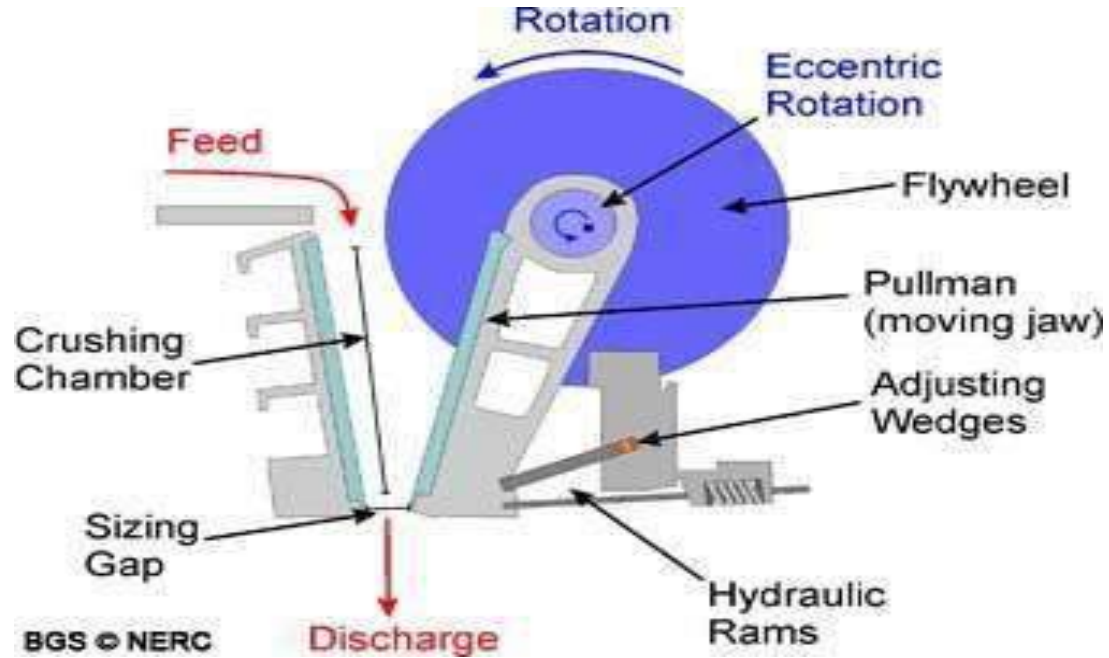
Aggregate production equipment

- Crushers are used mainly to reduce the size of large stone or rock to smaller uniform sized aggregates required for concrete mix.
- Crushing consists of
 - Pressure,
 - Impact,
 - Attrition
 - A combination of these operations.

Jaw crushers

- It is one of the primary crushers.
- It operates by allowing stone to flow into the space between two jaws, one of which is stationary and other is movable, which together constitute the crushing surfaces.
- The distance between the two jaws decreases as the stone travels downward under the effect of gravity and ultimately passes through the lower opening.
- The moveable jaw is capable of exerting a pressure sufficiently high to crush the hardest rock.
- The movable jaw is suspended from a shaft mounted on bearings on the crusher frame.
- The jaw plates are made of manganese steel which can be removed, replaced or reversed.

Jaw crushers



Gyratory crusher

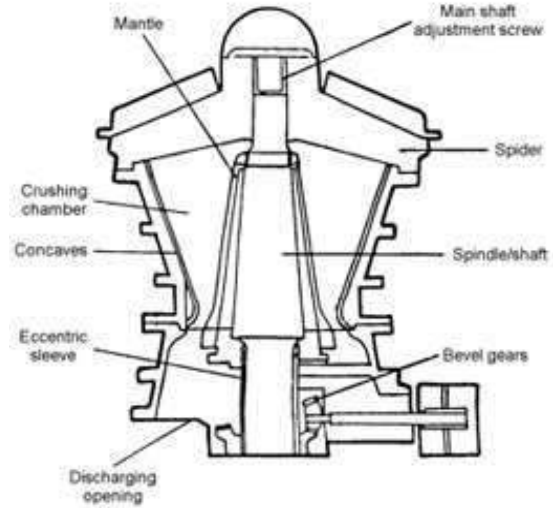
- This is another type of primary crusher.
- This type of crusher comprises a hardened steel head has a long conical shape, with a trough shaft suspended in a bearing at the top, and an eccentric base connection connected to gears.
- Thus, as the cone is rotated, the gap between itself and the walling changes from a maximum to minimum for each cycle.
- The rock is feed into the chamber at the top and as it moves downward, crushing is done and finally emerges through the bottom gap.
- The size of this type of crusher is the width of the receiving opening measured between the concaves and the crushers head.
- It is available in sizes varying from 20cm to 200cm.

Cone crusher

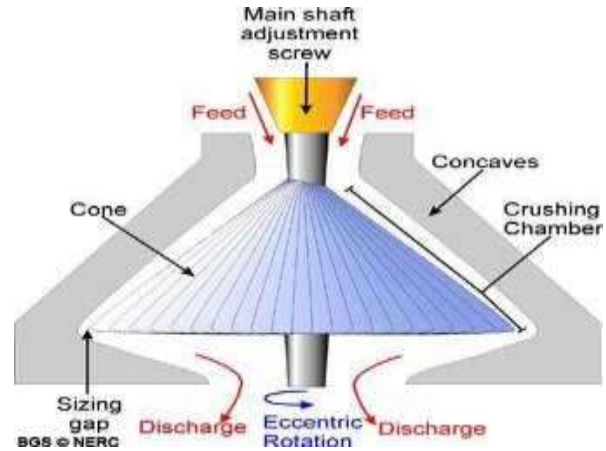
- Cone crusher are used as a secondary or tertiary crusher.
- These crusher are capable of producing large quantities of uniformly fine crushed stone.
- It has shorter cone with smaller inlet and outlet openings as compared to the gyratory crusher.

Roll crusher

- Roll crushers are also one of the secondary or tertiary crushers.
- This crusher consists of a heavy cast iron frame equipped with two counter rotating rollers mounted on a separate horizontal shaft.
- The crushed rock from the primary crusher is feed through the gap between the two rollers for crushing further.
- Usually one roller has a fixed axis while the other can be adjusted to give the required setting.
- The crusher is compact, light weight and low in cost.

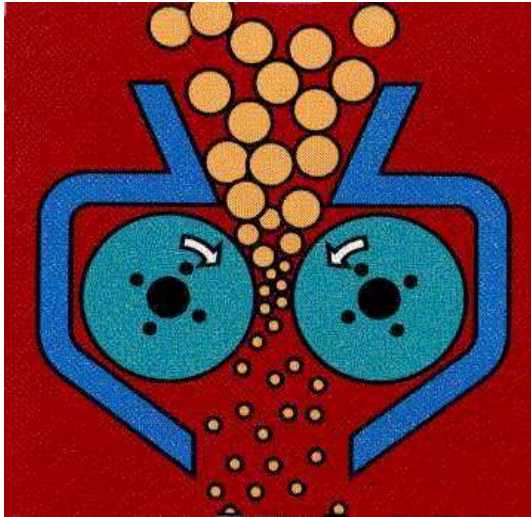


Gyratory crusher



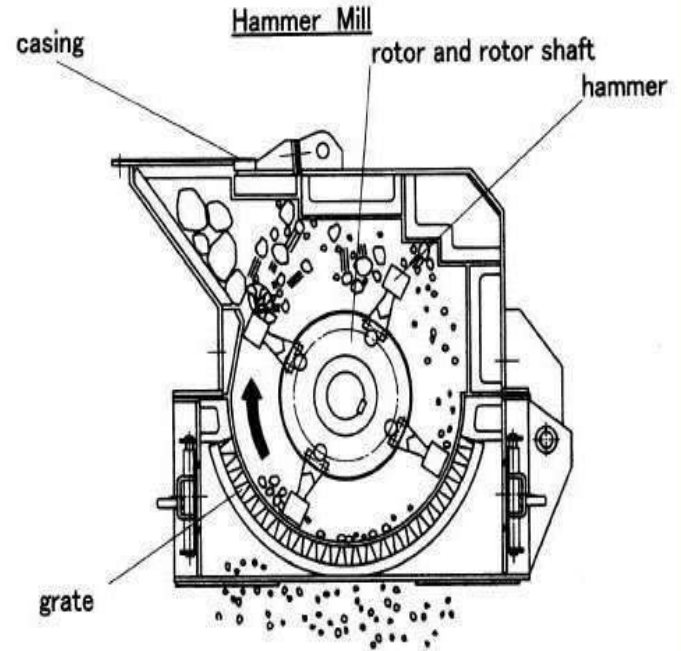
Cone crusher

Roll crusher



Hammer mill

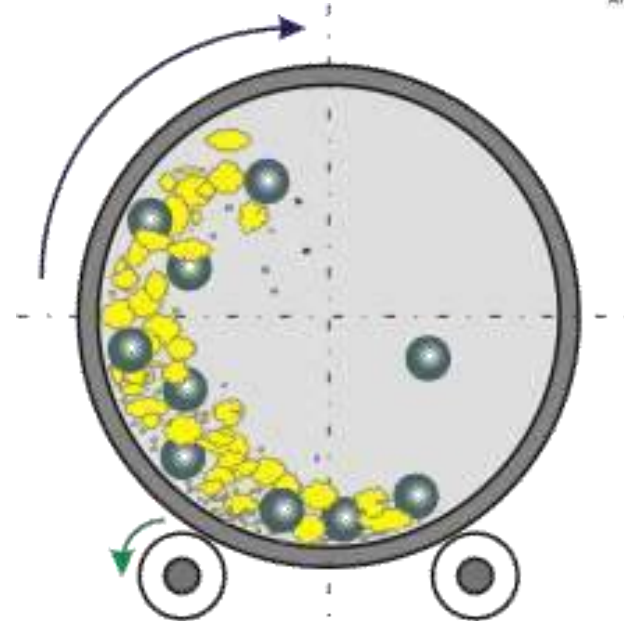
- Hammer mill is one of the impact crushers mostly used as primary or secondary crusher.
- It consists of a housing frame, a horizontal shaft extending through the frame, number of frames and hammers attached to the frame and one more hard steel breaker plates.
- As the stone is feed to the mill, the hammers, which are driven by a motor, move at the high speed and brake the stone into pieces and driving them against the hard plate, further reduce their size.



Rod mill and ball mill

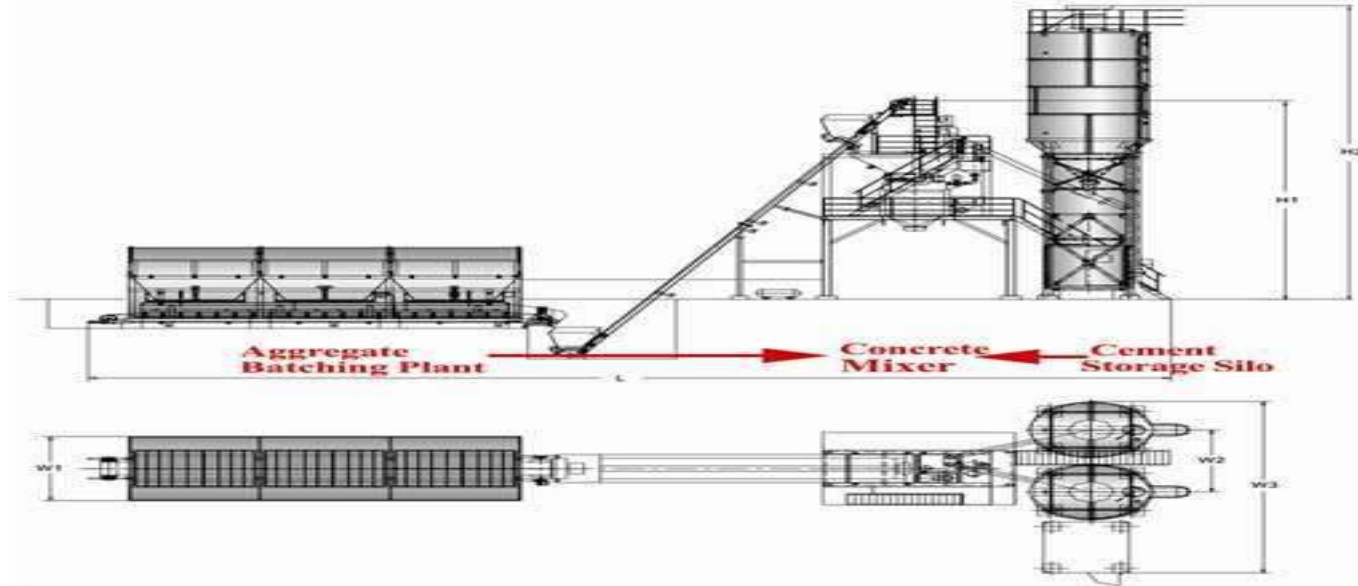
- This are the tertiary crushers.
- A rod mill consist of a circular steel shell.
- The interior of the shell is lined on the inside with a hard material wearing surface.
- The shell contains a number of steel rods.
- The length of these rod is slightly less then the length of the shell.
- Crushed stone is feed through the inlet and fine aggregate of the size of sand is discharged at the other end.
- If the rods are replaced by steel balls to provide the impact required the grind the stones, the crusher is known as the ball mill crusher.
- The size of the balls generally used is 50 mm dia. Size.

Rod mill and ball mill



Concrete production plants

- For mixing different ingredients in required proportion.
- It consists of storage bins for storing materials like cement and admixtures.
- Aggregate is mix in it with the help of a hopper which is fixed in plant.



Pile driving equipment

- The process of pile driving involves lifting the piles into position, holding it to refusal or to a specified depth.
- Driving is accomplished through hammering the pile top with a hammer.
- Equipment are so designed for driven effectively at an economical cost.
- Major pile driving equipment are:
 - Pile driving rigs
 - Pile driving hammers



CFG pile driving machine



Rotary drill rig

ASSIGNMENT QUESTIONS

1. Describe the different types of compaction rollers.
2. Differentiate between Jaw and Gyratory Crushers based on their use and application
3. Briefly explain about Hoisting equipment.
4. Describe the difference between hoists and cranes with their applications

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Thank
you



CONSTRUCTION MATERIALS, EQUIPMENT & MANAGEMENT



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Lecture Details:

Unit-III Topic: STAIRCASES AND ITS TYPES

What is stairs ?

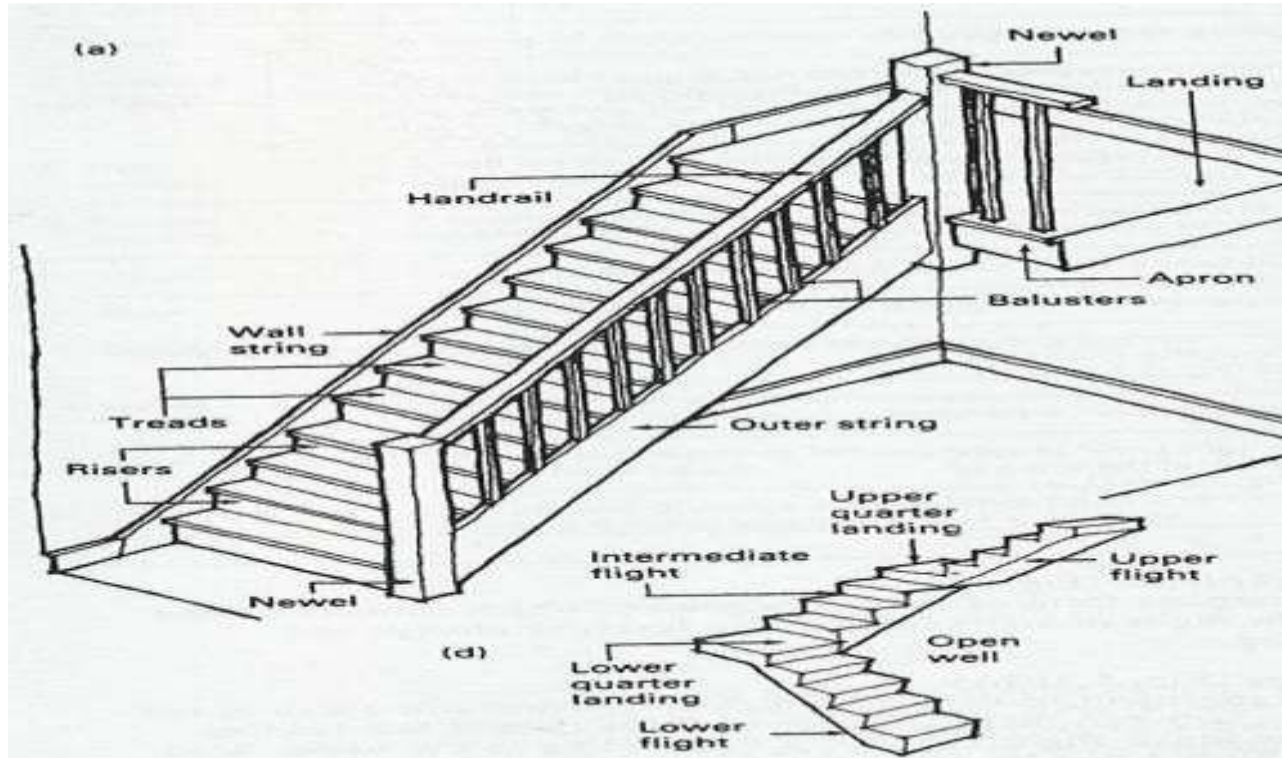
- “A Stair is a system of steps by which people and objects may pass from one level of a building to another.”
- A stair is to be designed to span large vertical distance by dividing it into smaller vertical distances, called **steps**.



Location of Stairs

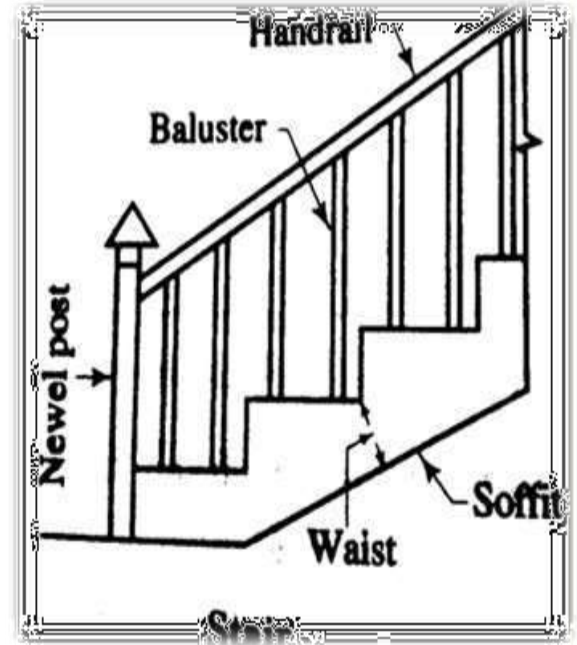
- It should be so located as to provide easy access to the occupants of the building.
- It should be so located that it is well lighted and ventilated directly from the exterior.
- It should be so located as to have approaches convenient and spacious.
- It public building it should be located near main entrance and in residential building it should be placed centrally.

Technical Terms in stairs



- The definitions of technical terms used in connection with the stairs are as follows:

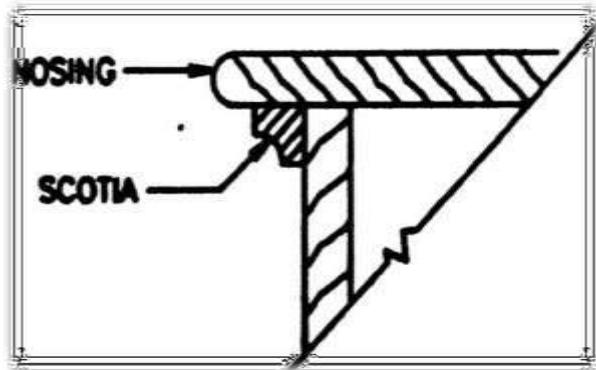
- 1) **Baluster** :- It is vertical member of wood or metal supporting the hand rail.
- 2) **Handrail** :- The inclined rail over the string is known as a handrail.
- 3) **Newel post** :- This is the vertical member which is placed at the ends of flights to connect handrail.
- 4) **Soffit** :- It is 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 beyond the face of the riser.

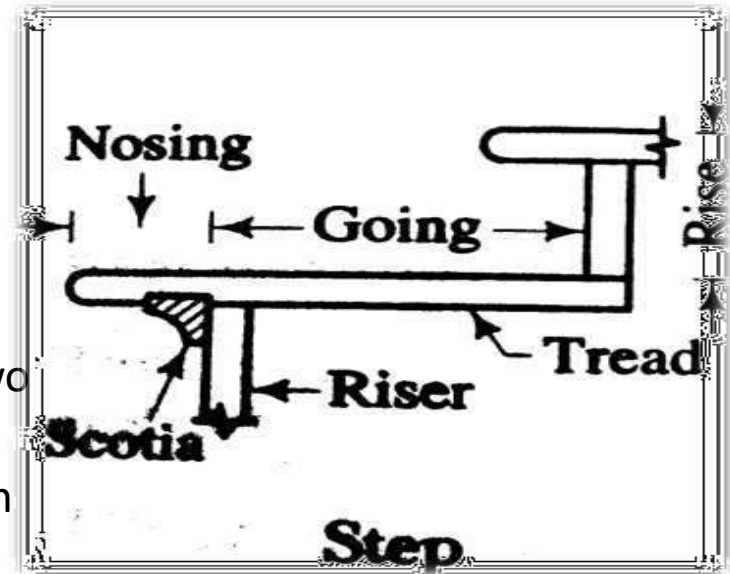
It is rounded to give good architectural effect.

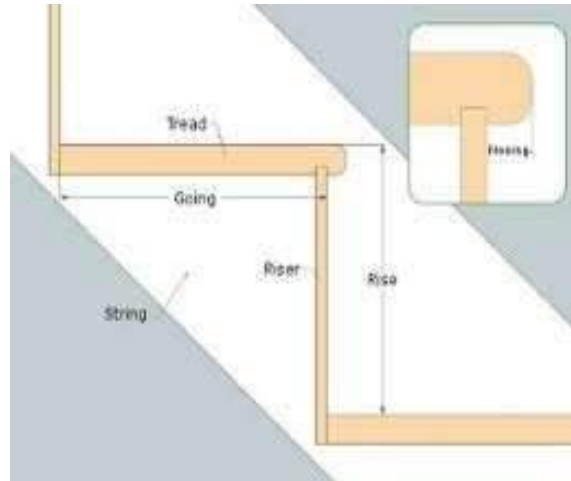
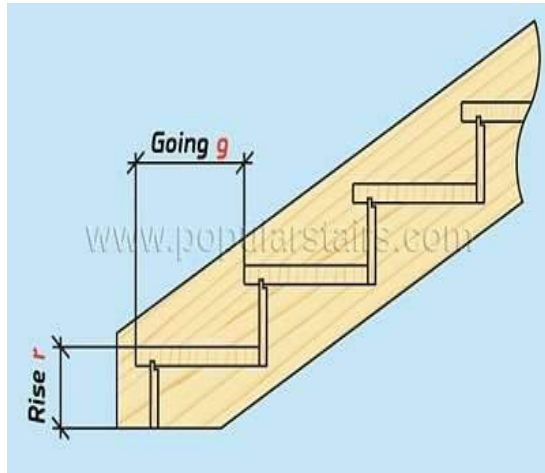
7) **Scotia** :- It is a moulding provided under the nosing to improve the elevation of the step.



Handrail

- 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 are placed while ascending or descending.
- 10) **Rise** :- It is the vertical distance between two successive treadfaces.
- 11) **Going** :- It is the horizontal distance between two successive riserfaces.





Tread

- 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.



19) Winders :- These are tapering steps which are provided for changing the direction of stair.

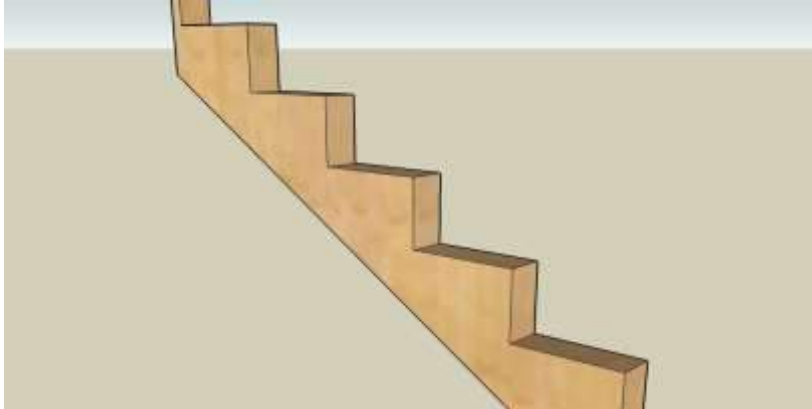
20) Strings or stringers:- These are the sloping wooden members which support the steps in a stair. They run along the slope of the stair.

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.



Strings



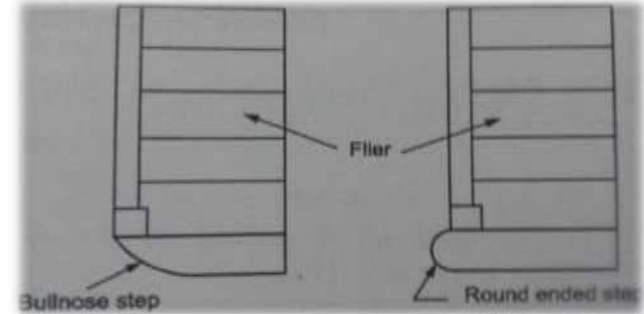
Balustrade

Types Of Steps..

Steps in a stair may be of following types :

- 1) Bull nose 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) **Flier** :- A flier is an ordinary step of uniform width and rectangular shape in plan.

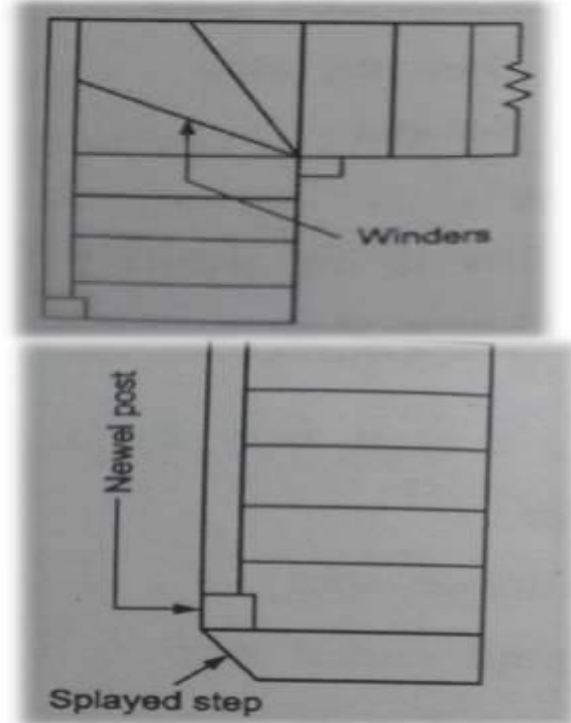


4) Commode step :- A commode step has curved tread and riser.

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.

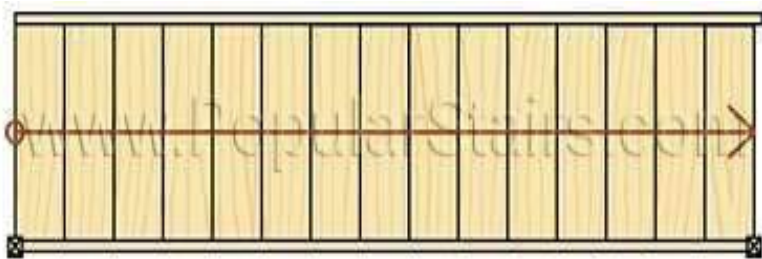


Types of stairs



STRAIGHT STAIRS

- 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**.

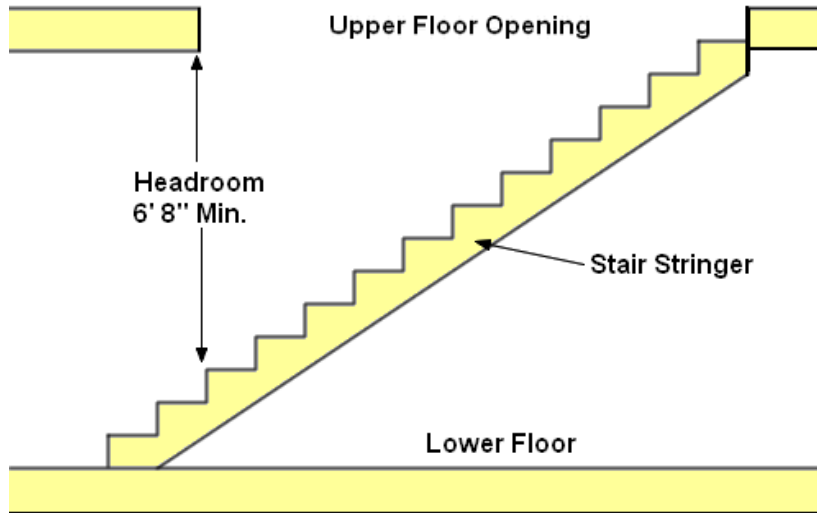


Plan



Elevation

Basic Straight Stair Stringer



Straight-stairs-with-intermediate-landing

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)

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 types of stair is commonly used in the public buildings near the entrance hall .

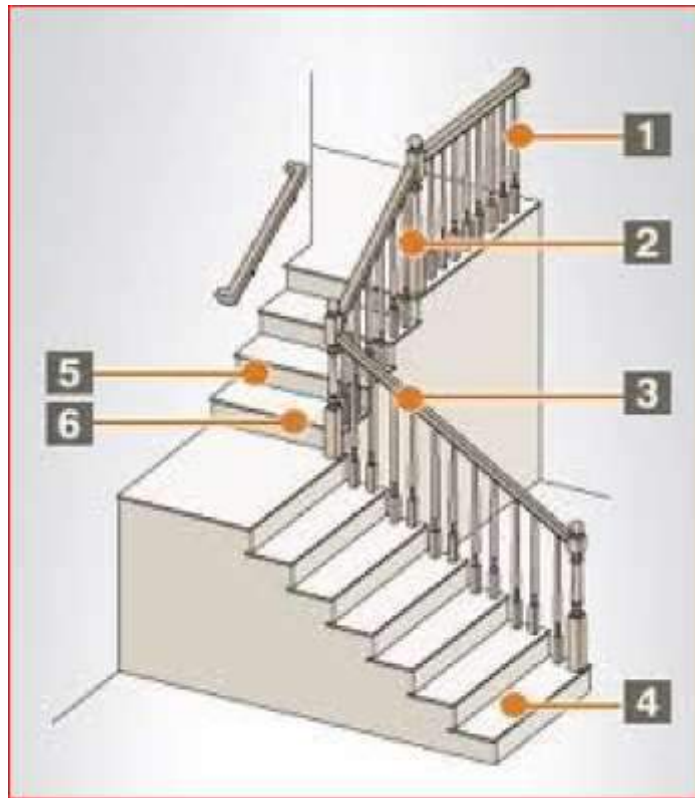
- The stair has a wider flight at bottom which bifurcates into two narrower flights at the landing.

one turn into left and the other to the right.

This staircase has either equal or unequal flights.



Quarter turn stairs



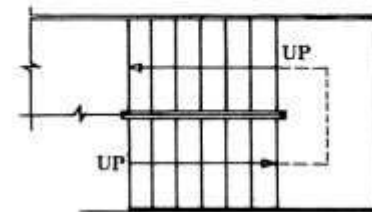
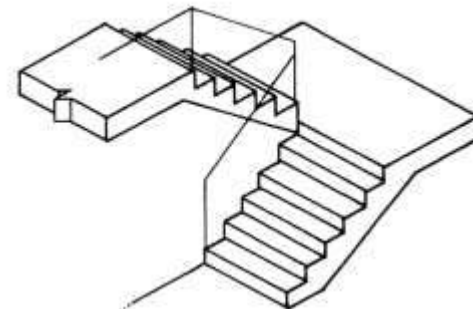
2. *Half Turn Stairs:*

- 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 or geometrical stairs



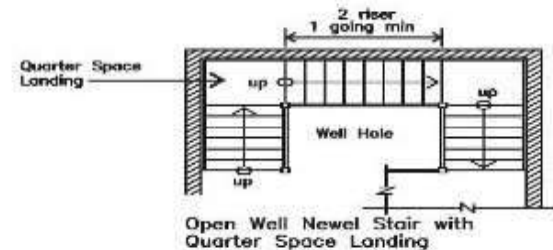
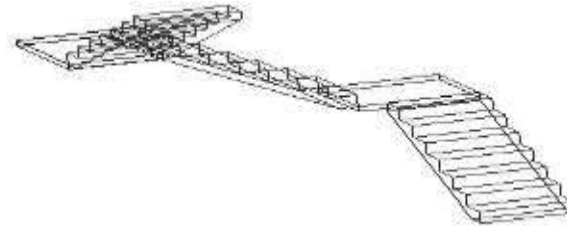
DOG-LEGGED STAIR

- 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.
- These 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 halfspace 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.



Geometrical Stair

These stairs have no newel post and are of any geometrical shape. The change in direction is achieved through winders. The stairs require more skill for its construction and are weaker than open newel stair.

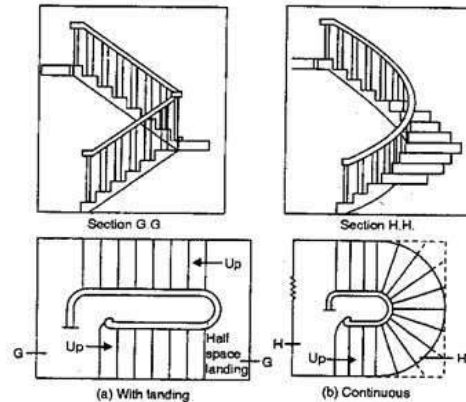


FIG. 14.8. GEOMETRICAL HALF TURN STAIRS.

Newel Post is not used in this type of half turn stair case

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.

The treads and risers are supported on the angles which are connected to the stringers.

The risers may be totally omitted in some cases.

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

For metal stairs the metal balusters with handrail of pipe are used.

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 & Spiral Stair

It is known as spiral stair.

When viewed from top it appears to follow a circle with a single centre of curvature.

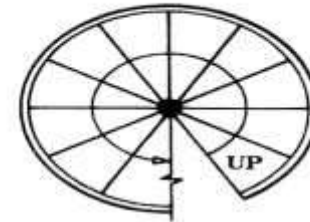
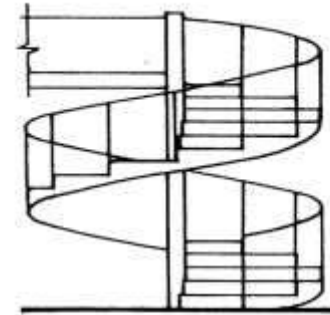
The spiral stairs are provided where space available is limited and traffic is low.

These stairs can be constructed in R.C.C., Steel or Stone.

Space Limitation

Emergency Stair with winder steps

Uncomfortable



- 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 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



CIRCULAR STAIRS