

UNIT-V :

CONCRETING EQUIPMENT

CRUSHERS -

Crushers are sometimes classified according to the stage of crushing that they accomplish, such as primary, secondary, and tertiary. A primary crusher receives the stone directly from the excavation after blasting and produces the first reduction in stone size.

They are three types of crushers

- * Jaw Crushers
- * gyratory Crushers
- * Impact Crushers

Jaw Crushers -

Machines operate by allowing stone to flow into the space b/n two jaws. One of which is stationary while the other is movable. The space b/n the jaws diminishes as the stone travels downward under the effect of gravity and the motion of the movable jaw. Until the stone ultimately passes through the lower opening. The movable jaw is capable of exerting a pressure sufficiently high to crush the hardest rock. Jaw crushers are usually designed with the toggle as the weakest part. The toggle will break if the crusher

Encounters an uncrushable object or is subjected to overload. This limits damage to the crusher.

Gyration

Double toggle:-

A double - toggle jaw crusher. The Blake type has a movable jaw suspended from a shaft mounted on the crusher frame. The rotation of a second shaft, which is eccentric and is located behind the movable jaw, raises and lowers the pitman, actuating two toggle, and these produce the crushing action. As the pitman raises the two toggles, a high pressure is exerted near the bottom of the swing jaw that partially closes the opening at the bottom of the two jaws. This operation is repeated as the eccentric shaft is rotated. The jaw plates are replaceable. The jaws may be smooth or in the event the stone tends to break into slabs. Corrugated jaws may be used to reduce the slabbing.

Single toggle:-

When the eccentric shaft of the single - toggle crusher, as illustrated is rotated. It gives the movable jaw both a vertical and horizontal motion. This type of crusher is used quite frequently in portable rock-crushing plants because of its compact size lighter weight, and reasonably sturdy construction.

Gyratory Crushers :-

Gyratories are the most efficient of all primary type Crushers. A gyrating mantle mounted within deep bowl characterizes these Crushers. They provide continuous crushing action and are used for both primary and secondary crushing of hard, tough, abrasive rock.

True gyratory :-

A Section through a gyratory Crusher.

The Crusher Unit consists of a heavy cast-iron or steel frame, with an eccentric shaft and driving gears in the lower part of the unit. In the upper part there is a cone-shaped crushing chamber, lined with hard-steel or manganese-steel plates called the "Concaves". The crushing member includes a hard-steel crushing head mounted on a vertical steel shaft. This shaft and head are suspended from the spider at the top of the frame that is so constructed that some vertical adjustment of the shaft is possible.

The size of a gyratory Crusher is the width of the receiving opening, measured b/w the concaves and the crusher head. The setting is the width of the bottom opening and may be the open or closed dimension.

Normally the Capacity of a "true gyrator" crusher is based on an open-size setting.

The size selected may be dictated by of the rock from the blasting operation. or it may dictated by a desired Capacity.

Impact Crushers -

Impact Crusher fracture the feed stone by the application of high-speed impact forces. Advantage is taken of the rebound b/n the individual stones and against the machine surfaces to fully exploit the initial impact energy. The design of some impact crushers also utilizes shear and compression. In addition to impact action to fracture the stones, this is accomplished by forcing the stone b/n the revolving and stationary parts of the crusher. Speed of rotation is important to the effective operation of these crushers as the energy available for impact varies as the square of the rotational speed.

→ Single Rotor -

The single rotor-type impact crusher breaks the stone both by the impact action of the impellers striking the feed material and by the impact that result when the impeller-driven material strikes against the aprons within the crusher unit. These crushers produce a cubical product but are economical only for low-abrasion feeds.

Q. 2. Double rotor - These units are similar to the single rotor models and accomplish aggregate-size reduction by the same mechanical mechanisms. They will produce somewhat higher proportion of fines.

→ Hammer mills - The hammer mill, which is the most widely used impact crusher, can be used for primary or secondary crushing. The basic parts of a unit include a housing frame, a horizontal shaft extending through the housing, a number of arms and hammers attached to a housing, a number of arms and hammers attached to a spool, which is mounted on the shaft, one or more manganese-steel or other hard-steel breaker plates, and a series of grate bars, whose spacing can be adjusted to regulate the width of openings through which the crushed stone flows.

* Selection of crushing equipment -

In selecting crushing equipment, it is essential that certain information be known prior to making the selection. The information needed includes, but is not necessarily limited to, these items.

1. The kind of stone to be crushed.
2. The required capacity of the plant - needed.

Output production.

3. The maximum size of the feed stones (concerning ^{type} //)
The size range of the feed is a helpfull)
4. The method of feeding the crushers.
5. The specified size range of the product.

* Screening of Aggregate:-

The Screening process is based upon the simple premise that particle size smaller than the screen cloth opening size will pass through the screen and that oversized particles will be retained.

Screen opening can be described by either of two terms:

1. Mesh
2. Clear Opening

1. Mesh:- The mesh refers to the number of openings per linear inch to count the number of openings to an inch. Measure from the center of the screen wire to a point 1-in distance.

2. Clear Opening:- Clear opening 'or' "space" is a term that refers to the distance b/w the inside edges of two parallel wires.

Types of Screenings:-

The Screenings are Following Three types

1. Revolving Screens
2. Vibrating Screens
3. Horizontal Screens

1. Revolving Screens:- Revolving Screens have several advantages over other types of Screens, especially when they are used to wash and screen sand and gravel. The operating action is slow and simple, and the maintenance and repairs costs are low. If the aggregates to be washed contains silt and clay. a scrubber can be installed near the entrance of a screen to agitate the material in water. At the same time streams of water can be sprayed on the aggregate as it moves through the screen.

2. Vibrating Screens:- Vibrating Screens consist of one or more layer or "decks" of open mesh wire cloth mounted one above the other in a rectangular metal box. These are the most widely used aggregate production screens. The vibration is obtained by means of an eccentric shaft, a counter weight shaft, or electromagnets attached

to the frame or to the screens.

A unit may be horizontal or inclined high ^{min} slope (20° or less) from the receiving to the discharge end. The vibration, 850 to 1,250 strokes per min causes the aggregate to flow over the surface of the screen. Normally, large amplitude and slower speed are necessary for large screen openings, and the opposite is necessary for small screen openings.

3. Horizontal Screens —

Horizontal Screens, the throw of the vibrations must move the material both forward and up-ward. For that reason, its line of action of 45° relative to the horizontal.

Most of the particles that are smaller than the openings in a screen will drop through the screen while the oversize particles will flow off the screen at the discharge end. For a multiple-deck unit, the size of the openings will be progressively smaller for each lower deck.

A screen will not pass all material whose size are equal to or less than the dimensions of the openings in the screen. Some of this material may be retained on and carried over the discharge end of a screen. The efficiency of a screen can be defined as the ratio of the amount of material passing through a

→ 3. Mixers of all types and sizes are either free fall mixers or power mixers. Free Fall mixers termed "gravity mixers". Mix Concrete by lifting the ingredients with the aid of fixed blades inside a rotating drum and then dropping the material by overcoming the friction between the mixture and blades.

Power mixers blend concrete by rapid rotary motion of paddles inside the mixing drum. The size of a mixer is measured by volume manufacturers commonly categorize mixers by normal volume or drum size rather than by the "total volume" or the "dry charge". The nominal volume is the maximum batch capacity the output of mixer.

Mixer output is measured in "cf or cy" per hour depending on mixer size and is determined by the mixer's cycle time. Mixer cycle composed are

1. loading time
2. Mixing time
3. Discharging time

The estimation of mixer output for self-loading freefall mixers is commonly based on 40 cycle/hr or 1.5 min of total cycle time for mixer of up to 15 cf & 30 cycle/hr. 2 min of total cycle time for large mixer.

cf means cubic feet
cy means cubic yard.

Screen divided by the total amount that is ~~smaller~~ pass through, with the ratio expressed as a percent. The efficiency is obtained with a single-deck screening usually amounting to 90 to 95%. As additional are installed, efficiencies of these decks with ease, being above 85% for the second deck and 75% for the third deck.

* Concrete Mixers -

There are two types of concrete-mixing operation in use:

1. Transit mixed

2. Central mixed

Today, unless the project is in a remote location or is relatively large, the concrete is batched in a central batch plant and transported to the job site in transit-mix trucks, often referred to as ready mixed concrete trucks, or truck mixers.

When discussing concrete mixing and mixers, batch mixing should be distinguished from continuous or "flow-type" mixing. Whether on the job site or at the ready-mixed plant, concrete is usually mixed by batches. Only for specific applications is mixing continuous, namely, with continuous flow of concrete ingredients charged into one end of the mixer and continuous flow of concrete discharge at the other end.

Types of Concrete Mixers

They are 6 types of

Concrete mixers.

1. Free fall mixer
2. Tilting mixer
3. Reversible mixer
4. power mixer
5. pan mixer
6. Trough mixer

1. Free Fall Mixers:-

The drum of a free fall mixer can be filled and emptied by changing its direction of rotation. Opening it, or tipping it up. Rotation speed must carefully follow machine - specific instructions and should not be too fast so that the free fall of the mixture is not interrupted by the centrifugal force. Free fall mixing suits concretes that are not too stiff. Usually with a 2-in. minimum slump, as commonly used on construction sites. Truck mixers, discussed later, also use free fall mixing. Two common types of free fall mixers are tilting mixers and reversible mixers.

2. Tilting Mixers:-

These are commonly trailer-mounted or otherwise portable small to mid size mixers. Used either as main concrete mixing equipment

Sites or as ancillary equipment on sites served by ready-mixed concrete plants. The drum has two a one around which the drum rotates and another serves to change drum loading and mixing position (drum opening up) to discharge position (drum opening down). This position change is done manually by a dump wheel (or handle, in the smaller mixers) while drum rotation is electric, gasoline, or diesel powered.

Common outputs are in the range of 2 to 10 cy/hr. Large mixers, in the range of 5 to 15 cy, are used on central-mixed concrete plants.

3. Reversible Mixers:-

The drum on a Reversible mixers has one horizontal axis around which it rotates. There are two openings, one at each end of the drum; one for feeding the ingredients, the other for discharging the mixtures. In mixing position the drum rotates in the one direction. While for discharge rotation is reversed. Commonly self-loading reversible mixers are midsize to large-size units mounted on a two- or four-wheel trailer for transportation between sites.

4. Power Mixers:-

Power mixers, also termed puddle mixers, forced mixers, or compulsory mixers, mix concrete.

rapid rotary motion of paddles (or mixers heads) moving in centric or eccentric courses inside the drum. To prevent the concrete from sticking the drum side and bottom. Some of the paddles must constantly clean the concrete off the side and bottom and redirect it to drum's centre. The paddles are spring - connected to the drum to prevent them from breaking under the intensive mixing action. The intensive mixing also causes excessive wear to the drum's inner surface. Which is not present in free fall mixers. To withstand this wear, the inside of the drum is lined with small, easily replaceable plates that are produced of specialized abrasion - resistant material.

The mixing output of a power mixer is about 50 to 100% higher than that of a same - size free - fall mixer.

5. Pan Mixers :-

The paddles of a pan mixer are connected to a vertical shaft inside the pan-shaped drum. In turbomixers the vertical shaft is fixed and located in the centre of the drum.

1. Both the drum and paddles rotate in counter directions.

2. The drum is stationary while all the paddles rotate in the same direction.

3. The drum is stationary but paddles rotated in
Counted direction.

6. Trough mixers - These are power mixer that have a trough shaped drum (resembling a horizontally placed barrel cut by half). The single-shaft mixer has a horizontal shaft onto which the paddles are connected in a spiral like arrangement: in some models wave-shaped mixing arms replace the paddle. The combination of radial (rotary) and axial (horizontal) movements obtained produces a three-dimensional circulation path that further increases mixing intensity and therefore results in shortened mixing times.

Placing Concrete -

1. Buckets - Normally, properly designed bottom dump bucket enable concrete placement at the lowest practical slump. Care should be exercised to prevent the concrete from segregating as a result of discharging from too high above the surface or allowing the fresh concrete to fall past obstruction (such as the forms themselves in the case of column) gates should be designed so that they can be opened and closed at any time during the discharge of the concrete.

Manual OR Motor propelled Buggies:-

Hand buggies and wheel barrows are usually capable of carrying from 4 to 9 cu of concrete and this are suitable on many projects, either as the sole or main concrete placing equipment for small or as a complementary means of projects utilizing cranes or pumps as the major concrete-placing equipment. When considering the use of buggies and wheel barrows, the expense of building ramps, runways, and similar setups should be taken into account, as buggies and wheel barrows can only operate on smooth and rigid surfaces. Hand buggies are safer than wheel barrows they have two wheels rather than one.

3. Chutes and Drop pipes:-

Chutes are often used to transfer concrete from a higher elevation to a lower elevation they should have a round bottom. and the slope should be steep enough for the concrete to flow continuously without segregation. Truck mixers are normally equipped with built in swing (and often extendable) chutes. These chutes are hydraulically operated for direct placing of the mix when the concreting location is within chute reach. Drop pipes are used to transfer the concrete vertically down.

4. Belt Conveyors: - Belt Conveyors can be classified into types they are:-

1. portable or self-contained conveyors.
2. Feeders or Series conveyors.
3. Side-discharge or spreader conveyors.

All types provide for the rapid movements of fresh concrete but must have proper belt size and speed to achieve the desired rate of transportation. particular attention must be given to points where the concrete leaves one conveyor and either continues on the another conveyor or is discharged as segregation can occur at these points. The optimum concrete slump for conveyed concrete is from $2\frac{1}{2}$ to 3. A belt conveyor mounted on a track carrier being used to place low-slump was roller compacted concrete.

5. Concrete pumps: - pump require a steady supply of pumpable concrete to be effective today there are three types of pumps being manufactured.

1. piston pumps.
2. pneumatic pumps
3. squeeze pressure pumps

Most piston pumps currently contain two pistons, with one retracting during the forward stroke

are other to give a more continuous flow of concrete. The pneumatic pumps normally use a reblend discharge box at the discharge end to bleed off air and to prevent Segregation and Spraying.

* Pump with a pipeline :-

In this configuration, also termed a line pump. The pipeline is a separate system that must be assembled and connected to the pump before pumping operations begin. The pipe line is laid from the location of the pump to the concrete casting area.

In terms of pump mobility. Three types can be distinguished.

1. Stationary pump - The pump is mounted on a steel frame and stationed in a fixed location throughout construction. This configuration is suitable for limited-area sites with large and frequent concreting operations.

2. Trailer pump -

The pump is mounted on a one-or-two axle trailer to enable easy on-site relocation as well as movement b/w sites. It is suitable mainly for spread-out sites. ~~It is so~~ One pump can also serve several adjacent site as it can be moved b/w them according to concreting schedule.

3. Truck pump :- Not to be confused with truck-mounted pump and bottom. Combination this quick setup pump is moved b/n sites and operated on a standard truck chassis.

* CONSOLIDATING AND FINISHING :-

Consolidating concrete :- Concrete, a heterogeneous mixture of water and solid particles in a stiff condition, will normally contain a large quantity of voids when placed. The purpose of consolidation is to remove these entrapped air voids & to ensure complete filling of the forms. The importance of proper consolidation cannot be overemphasized, as the entrapped air can render the concrete totally unsatisfactory. Entrapped air can be reduced in two ways - Use more water or consolidate the concrete.

Consolidation is normally achieved through the use of mechanical vibrators, only in case of extremely small/thin elements and particularly with concrete mixture is consolidation by hand tools, such as a plastic-head hammer, allowed. Properly vibrated concrete is higher-quality concrete, mainly in terms of strength but also in terms of reinforcement protection, resistance to aggressive agents, and overall appearance. Vibrators and

Now, the vibrat action are characterized and distinguished by the wing properties.

1. Frequency :- The number of vibrations per unit time (commonly minutes).
2. Amplitude :- The Magnitude of the motion in each vibration.
3. Orientation :- There are vibrators with random motion at all directions, while others have Unidirectional motion only.

Surface vibrators exert their effects at the top surface of the concrete and consolidate the concrete from the top down. They are used mainly in slab construction. and there are four general types:

- They are :-
1. The vibrating screed.
 2. The pan-type vibration.
 3. The plate or grid vibratory tamper.
 4. The vibratory rolling screed.

These surface vibrators operate in the range from 3000 to 6000 vibration/min.

* Finishing and Curing Concrete :-

The finishing process provides the desired final concrete surface. Unformed surfaces may require only "screeding" to proper contour and elevation or a broom-floated, or troweled finish may be specified.

Furthermore, each step in the finishing operation, from first "floating" to the final floating or troweling, should be delayed as long as possible.

This duration is limited by the necessity to finish the concrete to the desired grade and surface smoothness while it can still be worked (still in a plastic state).

Floating has three purposes:-

1. To embed aggregate particles just beneath the surface.
2. To remove slight imperfections, high spots, and low spots and.
3. To compact the concrete at the surface in preparation for other finishing operations.