Stages for production of concrete:-

- ✓ **BATCHING**
- ✓ **MIXING**
- ✓ **TRANSPORTING**
- ✓ **PLACING**
- ✓ **COMPACTING**
- ✓ **CURING**
- ✓ **FINISHING**

➢ Batching:-

Batching is the process of measuring concrete mix ingredients by either mass or volume and introducing them into the mixer.

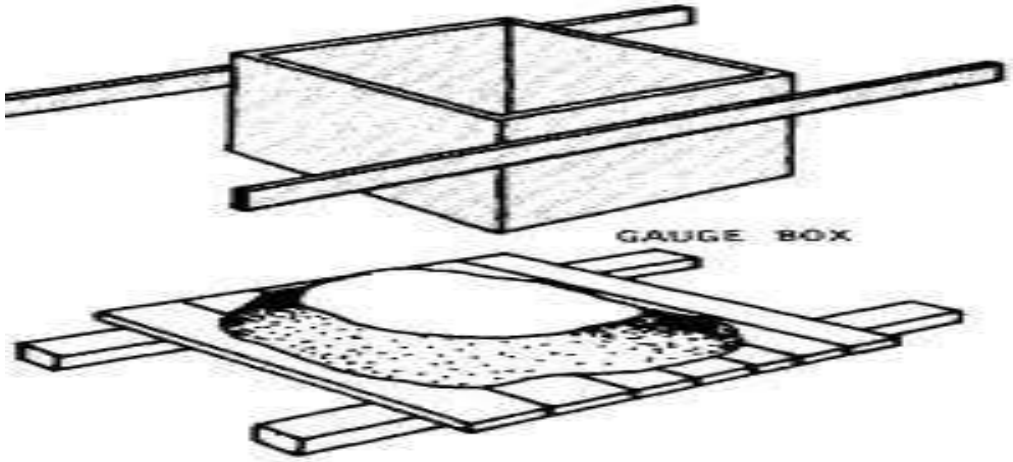
To produce concrete of uniform quality, the ingredients must be measured accurately for each batch.

- ✓ Volume batching
- ✓ Weight batching

➢ Volume batching:-

- This method is generally adopted for small jobs .
- Gauge boxes are used for measuring the fine and coarse aggregate.
- The volume of gauge box is equal to the volume of one bag of cement.

- Gauge bow are also called as FARMAS
- They can be made of timbers or steel.
- They are made generally deep and narrow
- Bottomless gauge boxes are generally avoided.
- While filling the gauge boxes the material should be filled loosely,no compaction is allowed.



Weigh Batching:-

- Batching by weight is more preferable to volume batching ,as it is more accurate and leads to more uniform proportioning.

- It does not have uncertainties associated with bulking.

➢ It’s equipment falls into 3 general categories :

I. Manual,

II. Semi automatic,

III. Fully automatic.

1) In case of manual batching all weighing and batching of concrete are done manually. It is used for small jobs.

•2) Semi automatic:-

- In it, the aggregate bin gates are opened by manually operated switches and gates are closed automatically when the material has been delivered.

- Contains interlock which prevents charging and discharging.

•3) Fully automatic:-

- In it, the material are electrically activates by a single switch and complete autographic record are made of the weight of each material.

- The batching plant comprises 2,3,4 or 6 compartment bins of several capacities.

•Over the conveyer belt ,the weigh batchers and discharging are provided below the bins.

Mixing:-

The mixing should be ensured that the mass becomes homogeneous , uniform in colour and consistency .

Methods of Mixing :

- 1.Hands(using hand shovels)
- 2.Stationary Mixers
- 3.Ready mix concrete

Hand Mixing:-

Mixing by hands using ordinary tools like, hand shovels etc.

This type of mixing is done for less output of concrete.

Procedure:-

1. Measured quantity of sand is spread evenly on platform.
2. Spread the measured quantity of cement on this sand and mix it till the colour of concrete mixture is uniform.
3. Spread the measured quantity of coarse aggregate on the platform with sand and cement.Now spread the mixture of cement and sand on the stack of aggregate and mix it atleast 3 times.
4. Add 3 quarters of total quantity of water required and turn the material towards the centre with spades.

Stationary Mixers:-

- Concrete is sometime mixed at jobsite in a stationary mixer having a size of 9 cubic meter .

➢ These mixers may be of :

1. Tilting type ,
2. Non-Tilting type ,

Tilting type mixer:-

- It consist a conical drum which rotates on an inclinable axis.
- It has only one opening.
- The drum charged directly and discharged by tilting and reversing the drum.

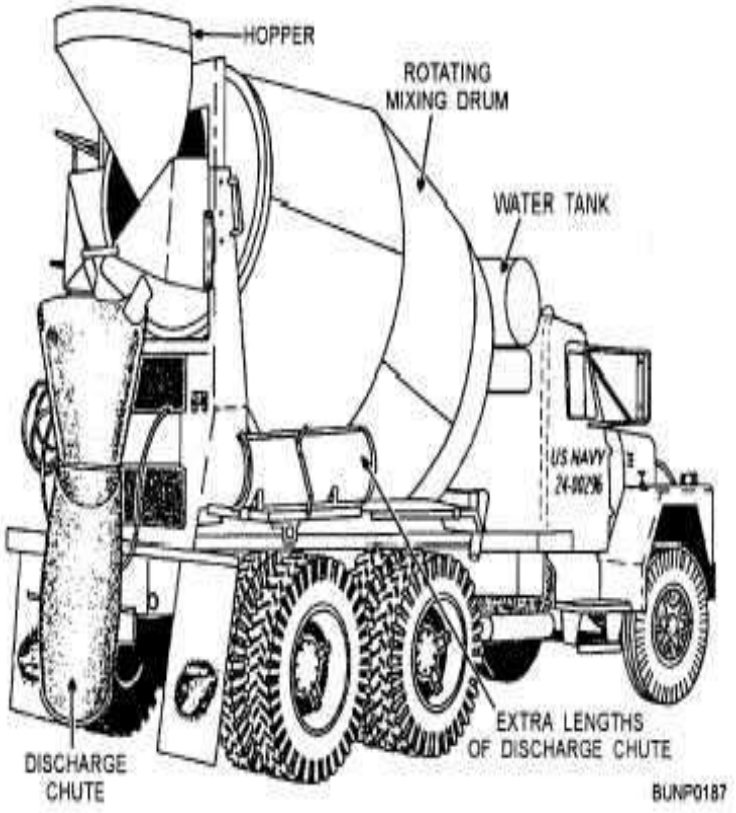
Non tilting type mixer:-

- The mixing drum is cylindrical in shape and revolves two – horizontal axis.
- It has opening on both sides.
- The ingredients are charged in from one opening.
- For discharging concrete chute is introducing to other opening by operating a lever.

20/14CFT (Two Bag) Capacity Non-Tilting Type Concrete Mixer Machine

Agitator Trucks:-

- **A vehicle carrying a drum or agitator body, in which freshly mixed concrete can be conveyed from the point of mixing to that of placing, the drum being rotated continuously to agitate the contents.**



Advantages: Operate usually from central mixing plants.

Watch for: Timing of deliveries should suit job organization.

- Concrete crew and equipment must be ready onsite to handle concrete.

Used for: Transporting concrete for all uses according the need.

Non-agitating Trucks:-

- **Used for:** Transport concrete on short hauls(small distance) over smooth roadways.
- **Advantages:** Cost of non-agitating equipment is lower than that of truck agitators or mixers.
- **Watch for:** Slump should be limited. Possibility of segregation. Height upon discharge is needed.

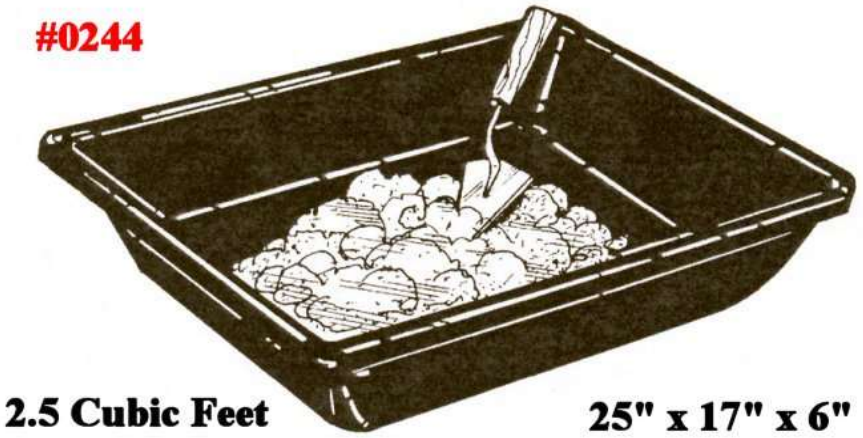
Truck-mixed concrete :-

- **Used for:** Intermittent (periodic) production of concrete at jobsite, or small quantities.
- **Advantages:** Combined materials transporter and batching and mixing system. One-man operation.

Transporting:-

1) Mortar Pan :

- Concrete is carried in small Quantities



2) Wheelbarrows and Buggies:

- **The capacity of wheelbarrows varies from 70 to 80 litres.**
- **Suitable for concrete road construction where concrete is deposited at or below mixer level.**

3)Belt Conveyors:

Conveying concrete horizontally or higher/lower level.

4) Cranes and Buckets:

- Used for Work above ground level , Buckets use with Cranes, cableways, and helicopters.

5) Pumps:

- Conveying concrete from central discharge point to formwork.

6) Transit Mixer:

- Used for transporting the concrete over long distance particularly in RMC plant .

Placing of concrete

The process of depositing concrete in its required position is termed as **placing**. Concrete should be placed in systematic manner to get optimum results.

Precautions:-

- Placing concrete within earth mould

- Concrete is invariable as foundation bed below the walls and columns before placing concrete
- All loose earth must be removed.
- Roots of trees must be cut.
- If surface is dry, it should be made damp.
- If it is too wet or rain soaked the water, then slush must be removed

➢ Placing concrete in layers with in timber or steel shutter :-

- This can be used in the following cases
- Dam construction
- Construction of concrete abutments
- Raft for a high rise building
- The thickness of layers depend on
- Method of compaction
- Size of vibrator
- Frequency of vibrator used
- It is good for laying 15 to 30 cm thick layer of concrete ,for mass concrete it may vary from 35 to 45 cm.
- It’s better to leave the top of the layer rough so that succeeding layer can have the good bond.

➢ Placing concrete with in usual form work:-

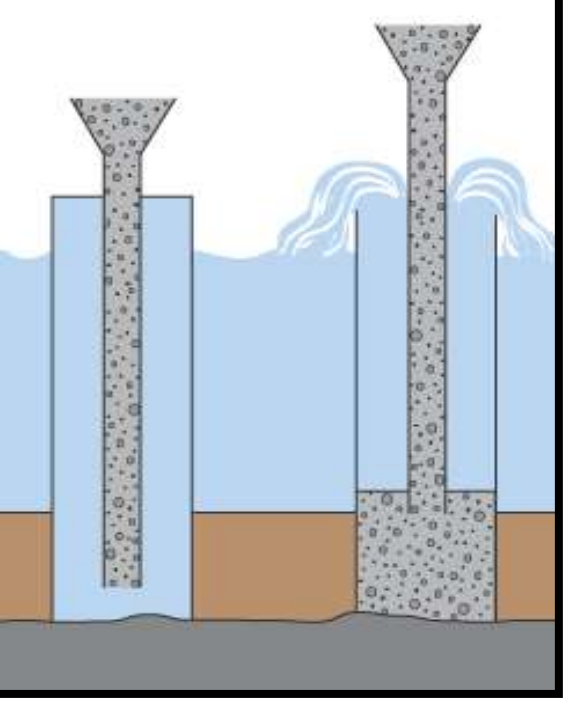
- Adopted for column ,beam and floors rules that should be followed while placing the concrete.
- Check the reinforcements are correctly tied and placed.
- Mould releasing agent should be applied.
- The concrete must be placed carefully with a small quantity at a time so that they will not block the entry of subsequent concrete.

➢ Placing concrete under water:-

- Concrete having cement content at least 450kg/m3 and a slump of 10 to 17.5cm can be placed underwater.

➢ Methods:-

1. Bagged method
2. Bottom dump method
3. Tremie
4. Grouted aggregate
5. Concrete pump



Placing Concrete Underwater:-

- **Used:** Tremie
- **Advantages:** Can be used to funnel concrete down through the water into the structure.
- **Watch for:** Discharge end always has to be buried in fresh concrete to ensure seal between water and concrete mass.

Compaction of concrete:

- Compaction of concrete is process adopted for expelling the entrapped air from the concrete
- In the process of mixing , transporting and placing of concrete air is likely to get entrapped in the concrete .
- It has been found from the experimental studies that 1% air in the concrete approximately reduces the strength by 6%.
- If we don’t expel this air, it will result into honeycombing and reduced strength

Different Methods Of Concrete Compaction:-

1) ## Hand Compaction:

- Rodding
- Ramming
- Tamping

2) ## Compaction by Vibration:

- Internal vibrator
- Formwork Vibrator
- Table Vibrator
- Platform vibrator
- Surface vibrator .

Hand Compaction:-

- Hand compaction is used for ordinary and unimportant structures. Workability should be decided in such a way that the chances of honeycombing should be minimum. The various methods of hand compaction are as given below:

❖Rodding:-

- It is a method of poking with 2m long, 16 mm dia. rod at sharp corners and edges. The thickness of layers for rodding should be 15 to 20 cm.

❖Ramming:-

- It is generally used for compaction on ground in plain concrete. It is not used either in RCC or on upper floors.

❖Tamping:-

- It is a method in which the top surface is beaten by wooden cross beam of cross section 10 cm x 10 cm.
- Both compaction and leveling are achieved simultaneously.
- It is mainly used for roof slabs and road pavements.

Compaction by Vibration:

- Vibration is imparted to the concrete by mechanical means.
- It causes temporary liquefaction so that air bubbles come on to the top and expelled ultimately.
- Mechanical vibration can be of various types as given under.

❖Internal Vibration:

- It is most commonly used technique of concrete vibration.
- Vibration is achieved due to eccentric weights attached to the shaft.
- The needle diameter varies from 20 mm to 75 mm and its length varies from 25 cm to 90 cm.
- the frequency range adopted is normally 3500 to 5000 rpm.

External Vibration

- This is adopted where internal vibration can’t be used due to either thin sections or heavy reinforcement.
- External vibration is less effective and it consumes more power as compared to the internal vibration.
- The formwork also has to be made extra strong when external vibration is used.

Table Vibration:-

- It is mainly used for laboratories where concrete is put on the table

Platform Vibration:-

- It is similar to table vibrators but these are generally used on a very large scale

Surface Vibration:-

- These are also called screed board vibrators.
- The action is similar to that of tamping.
- The vibrator is placed on screed board and vibration is given on the surface.
- It is mainly used for roof slabs, road pavements etc., but it is not effective beyond 15 cm depth.

Curing:-

- **Curing** is the process in which the **concrete** is protected from loss of moisture and kept within a reasonable temperature range.
- The result of this process is increased strength and decreased permeability.
- **Curing** is also a key player in mitigating cracks in the **concrete**, which severely impacts durability.

Curing:-

- Curing can be defined as a procedure for insuring the hydration of the Portland cement in newly-placed concrete.
- It generally implies control of moisture loss and sometimes of temperature.

Need for curing:-

- Causes Hydration reaction of cement with water.
- Loss of water by evaporation can be prevented.
- Maintain conductive Temperature .
- For completing of Hydration reaction.
- For capillary segmentation .

Methods of curing:-

- Immersion
- Ponding
- Spraying
- Covering with wet sand
- Wetted Hessian (gunny bags)
- Membrane curing
- Water proof plastic sheeting

Immersion:-

- The precast concrete items are normally immersed in curing tanks.
- The cement and concrete test tubes, cylinders, beams etc. In the test laboratories are cured by immersion.

Ponding:-

- Pavement slabs, roof slab etc. are covered under water by making small ponds.

- Fig: Ponding of slab

Spraying :-

- Vertical retaining wall or plastered surfaces or concrete columns etc. are cured by spraying water.

Wet covering:-

- Wet gunny bags, hessian cloth, jute matting, straw etc., are wrapped to vertical surface for keeping the concrete wet.

Covering with Gunny bags

Curing with water proof paper or sheet

Membrane curing:-

- In it, concrete is covered with membrane which effectively seal off the evaporation of water from concrete.

- It is carried out at the interface of the ground and concrete to prevent the absorption of water by the ground from the concrete.

- Membrane curing maintains a satisfactory state of wetness in the body of concrete to promote continuous hydration when original water/cement ratio used is not less than 0.5.

Application of heat:-

- The development of strength of concrete is a function of not only time but also that of temperature. When concrete is subjected to higher temperature it accelerates the hydration process resulting in faster development of strength.

- Subjecting the concrete to higher temperature and maintaining the required wetness can be achieved by subjecting the concrete to **steam curing.**

STEAM CURING AT ORDINARY PRESSURE:-

- This method is often adopted by prefabricated concrete elements.
- At some places it has been useful with the help of thick polyethylene sheets, but the rate of development of strength is not beneficial.

FINISHING:-

- The **finish** can be strictly functional or decorative.
- **Finishing** makes concrete attractive and serviceable.
- The final texture, hardness and joint pattern on slabs, floors, sidewalks, patios and driveways depend on the **concrete's** end use.