

CIVIL ENGINEERING MATERIALS

COURSE CODE: CE-116

LECTURE # 6



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Introduction to Concrete

- Concrete is a composite material consisting of binding material, well graded fine and coarse aggregates, water and admixtures (optional).
- In a concrete mix, cement and water form a paste which fill the voids of fine aggregate and coats the surface of fine and coarse aggregates to bind them together. The paste is usually 22-34% of the total volume.
- Freshly mixed concrete is known as wet or green concrete whereas after hardening it is known as hardened concrete.
- The molded concrete mix after sufficient curing becomes hard like stone due to chemical action between the water and binding material.



Introduction to Concrete

- Major factors responsible for wide usage of cement- concrete are mouldability, early hardening, high early compressive strength, development of desired properties with admixtures to be used in adverse situations and durability.
- Buildings—from single story to multi-storey, bridges, piers, dams, weirs, retaining walls, reservoirs, chimneys, runways, pavements and railway sleepers are few examples of concrete applications.



Components of Concrete

- Following are the main components of Concrete
 1. Cement
 2. Fine Aggregate (Sand)
 3. Coarse Aggregate (Crushed stones or Gravel)
 4. Water
- A Large number of Additives are also used to alter the concrete properties as desired, they are:
 1. Plasticizers, 2. Accelerators, 3. Retarders, 4. Fibers and 5. Polymers.



Manufacturing of Concrete

Various stages of concrete manufacturing are as follow:

1. Batching
2. Mixing
3. Transporting
4. Placing
5. Compacting
6. Curing
7. Finishing



Manufacturing of Concrete

1) 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.
- Basically there are two types of batching:
 - Volume batching
 - Weight batching



Manufacturing of Concrete

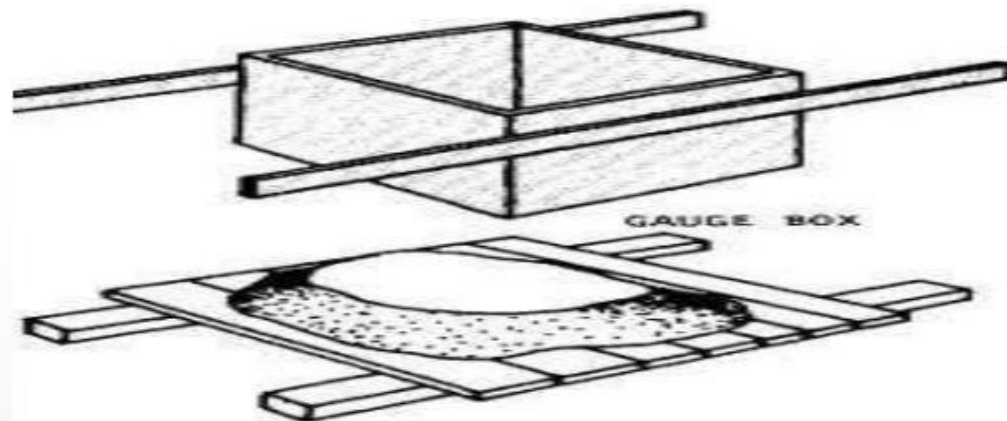
1) Volume Batching:

- 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 boxes are also called as FARMAS.
- They can be made of timbers or steel.

Manufacturing of Concrete

1) Volume Batching:

- They are made generally deep and narrow.
- While filling the gauge boxes the material should be filled loosely, no compaction is allowed.





Manufacturing of Concrete

2) Weight 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's fall into 3 general categories :
 - I. Manual,
 - II. Semi automatic,
 - III. Fully automatic.



Manufacturing of Concrete

2) Weight Batching

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

Manufacturing of Concrete

2) Weight Batching

- In case of **semi automatic** batching the aggregate bin gates are opened by manually operated switches . And gates are closed automatically when the material has been delivered.



Manufacturing of Concrete

2) Weigh Batching

- In case of **automatic batching** the equipments are electrically activated by a single switch and complete record are made of the weight of each material.
- The batching plant comprises 2,3,4 or 6 compartment bins of several capacities.





Manufacturing of Concrete

2) MIXING

The mixing should ensure 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

Manufacturing of Concrete



1.Hands(using hand shovels)



2.Stationary Mixers



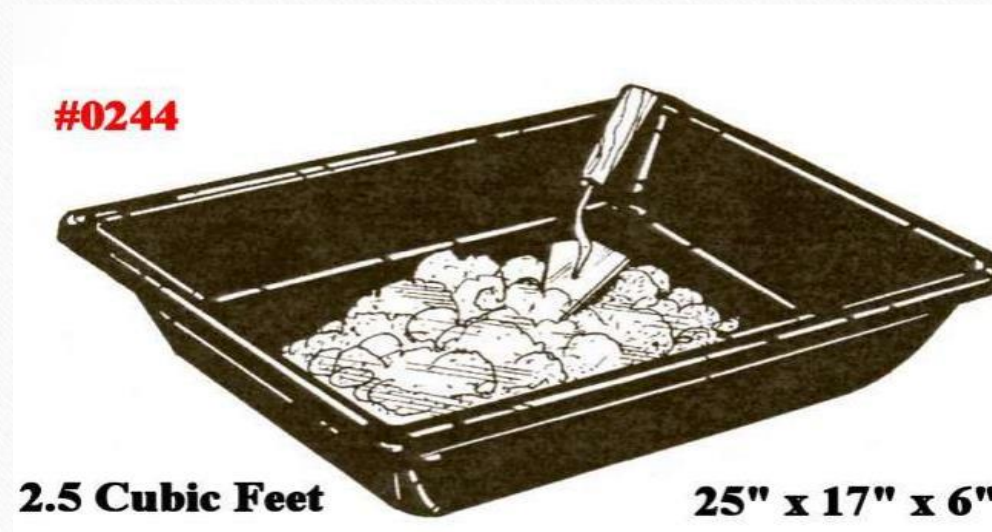
3.Ready mix concrete



Manufacturing of Concrete

3) TRANSPORTING

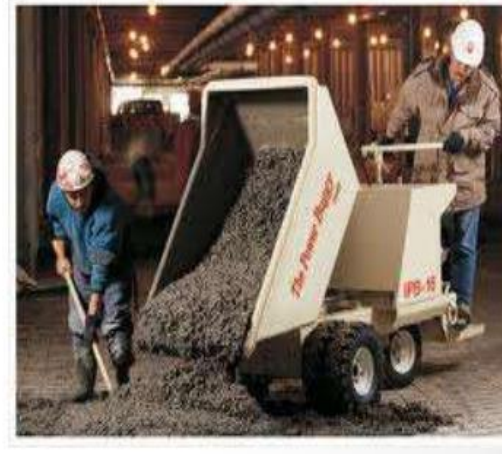
1) **Mortar Pan** : Concrete is carried in small Quantities.



Manufacturing of Concrete

3) TRANSPORTING

2) **Wheelbarrows and Buggies** : Short flat hauls or wheel barrows of onsite concrete construction



Manufacturing of Concrete

3) TRANSPORTING

3) **Belt Conveyors** : Conveying concrete horizontally or higher/lower level.

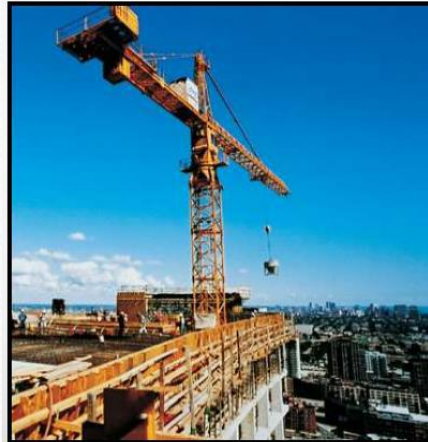


Manufacturing of Concrete

3) TRANSPORTING

4) **Cranes and Buckets** : Used for Work above ground level , Buckets use with Cranes, cableways, and helicopters.

helicopters.





Manufacturing of Concrete

3) TRANSPORTING

5) **Pumps** : Conveying concrete from central discharge point to formwork



Manufacturing of Concrete

3) TRANSPORTING

6) **Transit Mixer** : used for transporting the concrete over long distance





Manufacturing of Concrete

4) PLACING

- Placing refers to pouring concrete into the desired shape.
- For placing concrete, formwork of desired shape is used.
- Placing should be properly done to avoid failure of formwork / shuttering.
- Formwork should be water tight to achieve good quality concrete.



Manufacturing of Concrete

5) COMPACTION

- 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



Manufacturing of Concrete

6) CURING

- Once it is placed and compacted, the concrete must be cured before it is finished to make sure that it doesn't dry too quickly.
- Concrete's strength is influenced by its moisture level during the hardening process: as the cement solidifies, the concrete shrinks.
- If site constraints prevent the concrete from contracting, tensile stresses will develop, weakening the concrete.
- To minimize this problem, concrete must be kept damp during the several days it requires to set and harden.



Manufacturing of Concrete

7) CONCRETE FINISHING

Finishing may be **defined** as the process of levelling, smoothing, compacting and otherwise treating surface of fresh **concrete** or recently placed **concrete** to produce desired appearance.





Types of Concrete

1. Normal Strength **Concrete**.
2. Plain or Ordinary **Concrete**.
3. Reinforced **Concrete**.
4. Pre-stressed **Concrete**.
5. Precast **Concrete**.
6. Light – Weight **Concrete**.
7. High-Density **Concrete**.



Important Properties of Concrete

1) Workability:

- **Workability** means the ease of placement and workable **concrete** means the **concrete** which can be placed and can be compacted easily without any segregation.
- **Workability** is a vital property of **concrete** and related with compaction as well as strength.
- One characteristic of workability is consistency or fluidity which can be measured using slump test.



Important Properties of Concrete

2) Durability

- Concrete should be capable of withstanding the weathering effects, chemical action and should be able to resist load to which it will be subjected in service life.



Important Properties of Concrete

3) Water Tightness

- It is an important property of concrete that can be improved by reducing the amount of water in the mix.
- Excess water leaves voids and cavities after evaporation, and if they are interconnected, water can penetrate or pass through the concrete.
- Water tightness can be increased by improving effective compaction of concrete, controlling aggregate grading and using construction chemicals etc.



Important Properties of Concrete

4) Strength

- This property is usually of main concern. Normally it is determined by knowing the ultimate strength of a specimen in compression tested in the lab.
- Since concrete usually gains strength over a long period, (90 days) the compressive strength at 28 days is commonly used as a measure of this property.
- Concrete strength is influenced mainly by the water cement ratio , mix proportions and other factors.



Chemical Attacks on Concrete

Following are the different chemical actions on concrete structures:

- Sulphate attack
- Chloride attack
- Alkali aggregate reaction
- Carbonation
- Acid attack

THANK YOU