

25CE301 : BUILDING MATERIALS AND CONCRETE TECHNOLOGY

Topic: Unit IV: Fresh and Hardened Concrete

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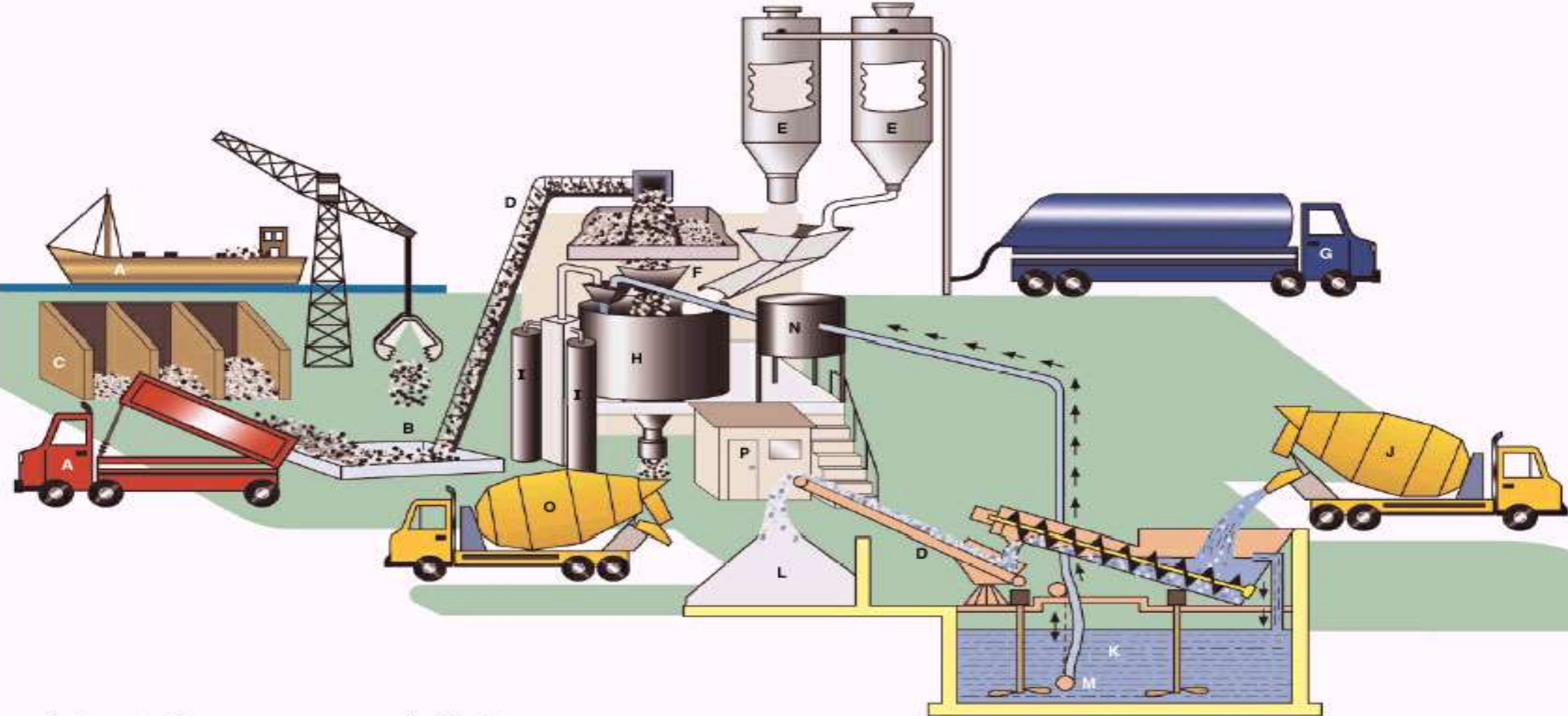
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Ordering or Specifying Concrete

- **Alternative (1) Common:** When the owner requires the concrete supplier to assume responsibility for the concrete mix proportions.
- **Alternative (2) Prescription:** When the owner assumes responsibility for the mix proportions and properties of the concrete.
- **Alternative (3) Performance:** When the owner requires the concrete supplier to assume responsibility for the concrete "as delivered".

Batching of Concrete

- 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.
- Most concrete today is batched and mixed by ready mixed concrete plants



- | | |
|------------------------------|--|
| A Aggregate delivery | I Admixtures |
| B Aggregate receiving hopper | J Ready mix truck with returned concrete |
| C Aggregate storage | K Recycled water |
| D Conveyor belt | L Reclaimed aggregates |
| E Cementing material storage | M Pump |
| F Weigh hopper | N Water storage |
| G Cement delivery | O Concrete loaded in ready-mix truck |
| H Mixer | P Control Room |

Fig. 10-4. Schematic of a central mix ready mix plant.

Transporting Concrete

Good planning and handling to avoid:

- Delays.
- Early Stiffening and drying out.
- Segregation.

Preparation Before Placing

Preparation prior to placing concrete includes the following:

- Compacting, trimming, and moistening the subgrade (see Figs. 11-1, 11-2, and 11-3);
- Erecting the forms;
- Setting the reinforcing steel and other embedded items securely in place.

Depositing the Concrete

- Concrete should be deposited continuously as near as possible to its final position without objectionable segregation.
- concrete should be placed in walls, thick slabs, or foundations in horizontal layers of uniform thickness; each layer should be thoroughly consolidated before the next is placed.
- To avoid segregation, concrete should not be moved horizontally over too long a distance.



Fig. 11-4. Wheelbarrows are used to place concrete in areas that are not easily accessed by other placement methods. (69929)

Consolidating Concrete

- the process of compacting fresh concrete; to mold it within the forms and around embedded items and reinforcement; and to eliminate stone pockets, honey-comb, and entrapped air.

Consolidation is accomplished by

- hand rodding, that is, thrusting a tamping rod or other suitable tool repeatedly into the concrete.
- or by mechanical methods.

Vibration

- The most widely used method for consolidating concrete.
 - Internal or immersion-type vibrators.
 - External vibrators.

Consequences of Undervibration

- (1) honeycomb: spaces between coarse aggregate particles do not become filled with mortar
- (2) excessive amount of entrapped air voids;
- (3) cold joints: discontinuity resulting from a delay in placement that allowed one layer to harden before the adjacent concrete was placed.

Consequences of Undervibration

- (4) placement lines: dark lines between adjacent placements of concrete batches
- (5) subsidence cracking: as concrete settles over reinforcing steel in relatively deep elements

Defects from overvibration include

- (1) segregation as vibration and gravity causes heavier aggregates to settle while lighter aggregates rise;
- (2) loss of entrained air in air-entrained concrete;
- (3) excessive form deflections or form damage;
- (4) form failure caused by excessive pressure from vibrating the same location too long.

Concrete Finishing

- **Screeding (Strikeoff)**

Screeding or strike off is the process of cutting off excess concrete to bring the top surface of a slab to proper grade

Concrete Finishing

- **Bullfloating or Darbying**

To eliminate high and low spots and to embed large aggregate particles, a bullfloat or darby should be used immediately after strikeoff.

Concrete Finishing

- **Brooming Finish**

Brooming should be performed before the concrete has thoroughly hardened, but it should be sufficiently hard to retain the scoring impression to produce a slip-resistant surface

Concrete Finishing

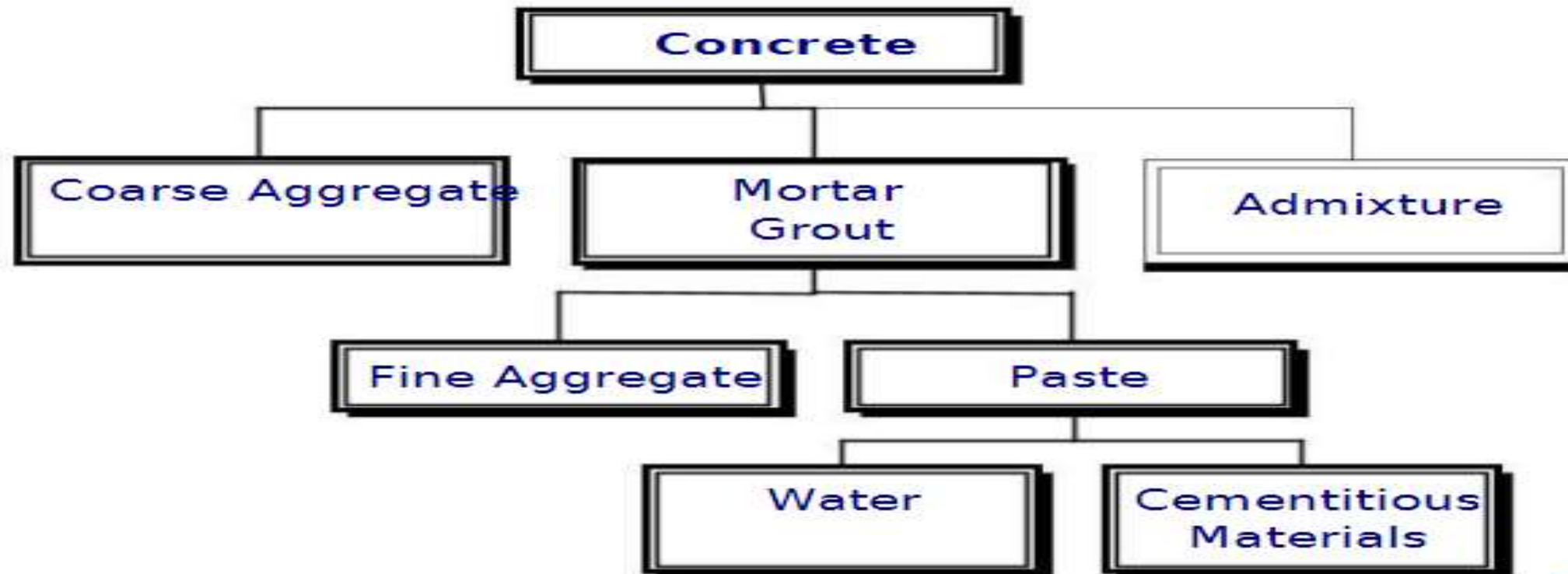
- Highway pavements are textured by "tining" the surface with stiff wires; this improves traction and provides vehicles with a surface that significantly reduces the chance of hydroplaning.

Curing and Protection

- A newly placed and finished concrete should be cured and protected from drying, extreme changes in temperature, and damage.
- The curing should begin immediately after finishing.

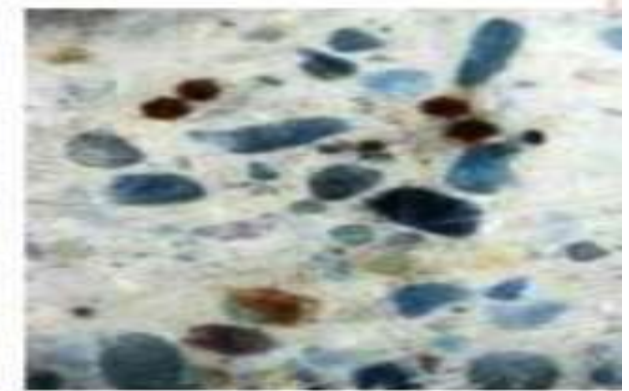
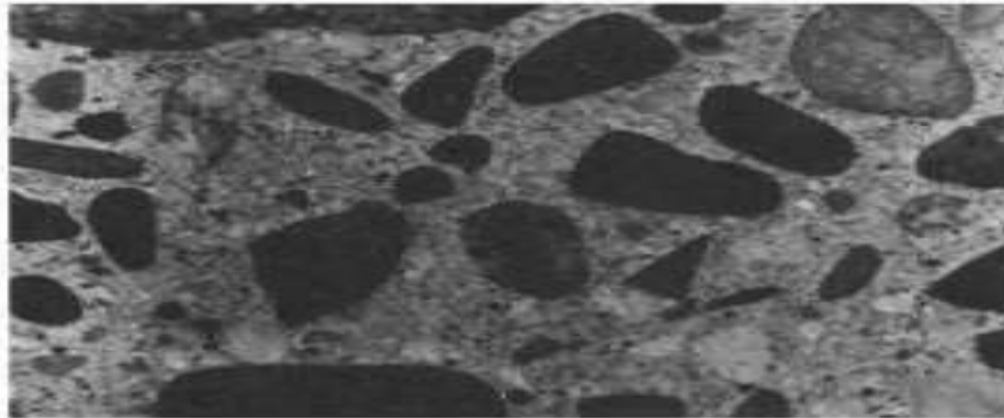
What is Concrete?

- ✓ Concrete is one of the most commonly used building materials.
- ✓ Concrete is a composite material made from several readily available constituents (aggregates, sand, cement, water and admixture (if required)).
- ✓ Concrete is a versatile material that can easily be mixed to meet a variety of special needs and formed to virtually any shape



Concrete Constituents

- Cement
- Fine Aggregate (sand)
- Coarse Aggregate
- Water
- Admixtures (If necessary)



Voids (2 – 8 %)

Cement paste
(25 - 40 %)

Aggregates
(60 - 75 %)

ADMIXTURES

What?

□ Admixture is a material added to plastic (fresh) concrete or mortar before or during mixing.

Why?

□ To change one or more properties of fresh or hardened concrete.

When to use admixture?

□ When the desired modification of properties of fresh or hardened concrete cannot be achieved by changing the composition of the mix proportion or by using different types of cement.

Types of admixtures

- Chemical admixtures:
- Mineral/Pozzolanic admixtures

Types of Admixture Effects

- **Accelerating admixture:** Accelerate setting time and rate of hydration, early strength development
- **Retarding admixture:** Delay setting time and rate of hydration
- **Water reducer:** Reduce water content; increase strength
- **Air entraining admixture:** Protect against freeze thaw cycles

Application

- Used in cold-weather condition, rapid removal of formwork or urgent repair work.
- When early strength is required.

Compressive strength at 3 days at least 25 % higher than normal concrete.

Cement + Coarse Aggregate + Fine aggregate + Water + Admixtures

Hydration of cement paste



Fresh concrete → Plastic state
(can be placed and compacted)



Hardened concrete
(retains shape, develops strength)



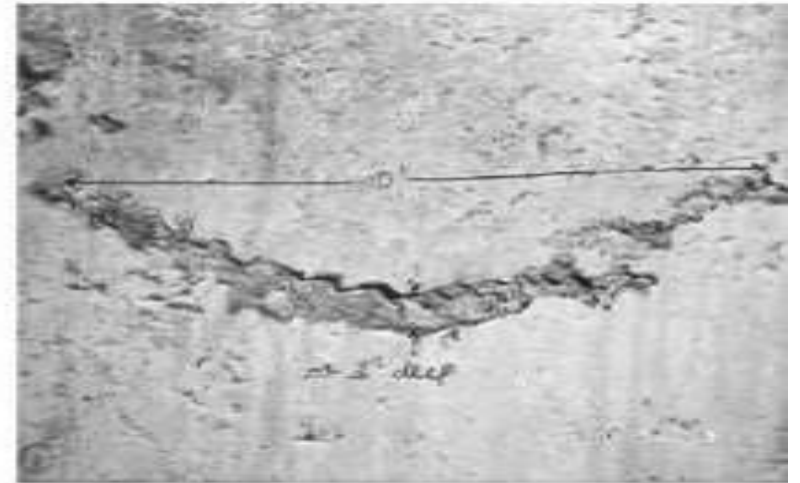
Use of concrete

- ❖ For building construction
- ❖ For road construction especially in bridge and rigid pavement(Portland Cement Concrete Pavement)
- ❖ For construction of reinforced concrete dam
- ❖ As a bedding material of different substructures



Concrete Quality

- Achieve the required strength / grade
- Workable
- Enough time for placing before setting
- Free from defects after formwork is removed (Uniform appearance of hardened concrete)
- Durable



The quality of concrete is governed

- Chemical composition of Portland cement Hydration
 - Aggregate characteristics
 - Amount of water
 - Admixtures
-
- The raw materials must be properly proportioned to ensure a quality concrete.

The quality of concrete will also be affected by

- Methods of mixing
- Transporting
- Placing
- Compaction
- Curing



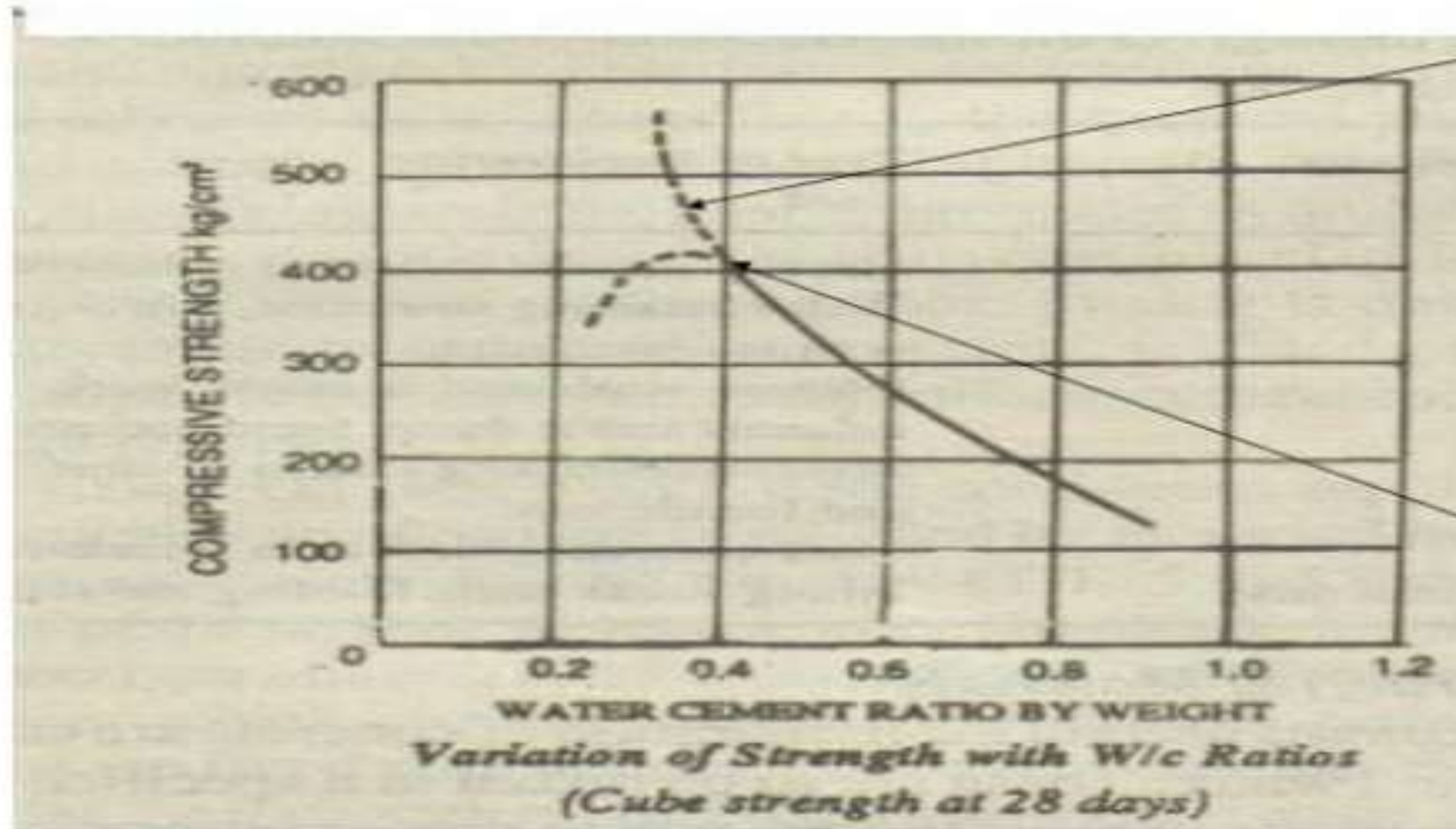
During construction



Properties of Concrete

- **Water Cement ratio (w/c ratio)**
$$= \frac{\text{weight of water in the mix}}{\text{weight of cement in the mix}}$$
- Water-cement ratio affects
 - strength and durability of concrete
 - workability of concrete
- Water-cement ratio for
 - (a) Normal strength concrete – 0.45 to 0.6
 - (b) High strength concrete – < 0.45

Variation of Strength with W/C ratio (Cube strength at 28 days)



Achieved under good compaction by mechanical vibration

Below 0.4 strength decrease because concrete is not workable



Thank You..