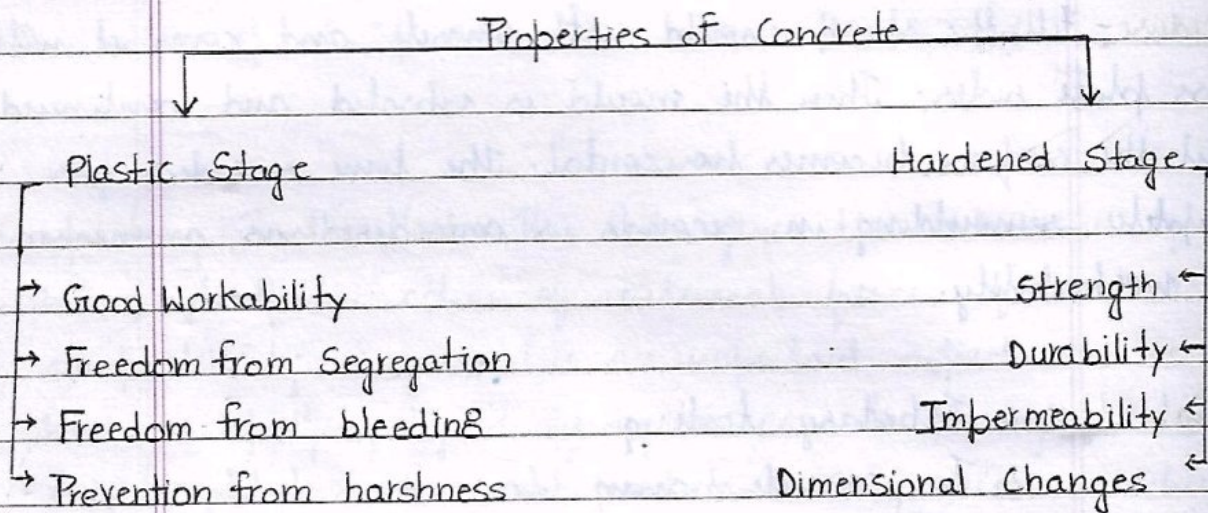


## Chapter 5 -

## Properties of Concrete



• Properties in Plastic stage - Freshly prepared concrete is also known as plastic / green concrete.

a. Workability - It is defined as the ease with which concrete can be transported placed and compacted. The optimum workability of concrete (in plastic stage) varies situation to situation. For Ex - Concrete workable for large sections may not be so workable for binding mortar.

b. Freedom from Segregation - It is defined as separation of aggregates from concrete mix to prevent it from being a homogenous mass. It results in porous layers & pockets in hardened concrete. It also reduces strength and durability of concrete. Following are its causes -

- a. Handling and placing operations not performed properly.
- b. Aggregates are poorly graded.

c Presence of too much water.

d Concrete mix is subjected to shocks while transportation.

e Under-water concreting.

- Prevention of Segregation -

a Strictly supervising concrete operations.

b Reducing concrete height drop ( $< 1$  m).

c Properly designing W/C ratio.

a Freedom from Bleeding - Bleeding is a undesirable property in which the water rises in the concrete mix to the surface because of the inability of the solid particles to hold all the water during setting of particles. Due to bleeding, water seum is formed on top of the concrete surface called laticance.

- Causes of bleeding -

a When excess water is present in concrete.

b When over concreting compacting is done.

c When fine aggregates are deficit in concrete mix.

- Prevention of bleeding -

a Designing proper W/C ratio.

b Controlling the amount of compaction.

c Providing suitable quantity fine aggregates.

- Prevention from harshness - Harshness is the property in which the concrete has too low W/C ratio and is not workable (too harsh to work).

• Properties of Concrete in Hardened stage - Hardening is a phenomena by which weak set paste develops strength. It has following properties -

a. Strength - The property to bear/resist external load of concrete is termed as strength. It depends on W/C ratio, quality and quantity of cement, compaction etc... The various strengths of concrete may be :-

- i. Compressive Strength - It is one of the major strength and has a great importance. It is the resistance of concrete to crushing.
- ii. Tensile Strength (Flexural strength) - Concrete is weak in tension. It is only 10% of its compressive strength. For it, reinforced steel bars are used along with them.
- iii. Shear strength - It is also 10-12% of its compressive strength. Shearing is always accompanied by tension & compression due to bending. It generally fails due to diagonal tension.
- iv. Bond strength - Bond strength is the measurement of adhesion between concrete and steel in RCC work.

b. Durability - Durability is the resistance offered to forces of deterioration and integration like temperature, moisture content etc. A concrete is durable, if it can withstand for the conditions it has been designed without deterioration for years.

\* Factors affecting durability -

a. Environment exposure conditions.

- Causes to reinforcement
- Attacks of harmful liquids / gases.
- Permeability of concrete.
- Poor workmanship in compaction and curing.

- Durability can be controlled / improved by -

- Close observation in concrete operations.
- Lesser / accurate W/C ratio.
- Use of good quality cement & well-graded ingredients.
- Proper curing.

• Impermeability - Clay is said to be impermeable, if it resists the flow of water into the pores inside it.

This property can be achieved by -

- Selecting well-graded aggregates.
- Proper and uniform compaction.
- Proper curing.

• Dimensional Changes -

• Shrinkage - The shrinkage that takes place after the concrete has been hardened is called drying shrinkage and takes place in first few months. Magnitude of shrinkage depends upon mix proportion and W/C ratio. Shrinkage cannot be eliminated, but can be reduced by :-

- Properly designed W/C ratio.
- Using saturated aggregates.

2. Creep - It is slight, continuous deformation shown by concrete when subjected to sustained loading. Creep is also known as plastic flow of concrete. On removal of the sustained load the creep does not disappear completely.

Factors affecting creep -

a. Age - Creep rate decreases with increases in time.

b. Strength - More the strength of concrete, lesser will be creep effect.

c. Curing Time - Inversely proportional to creep.

d. Alternate wetting and dry leads to increase in creep amount.

3. Elasticity - Concrete is not perfectly elastic, because here stress is not proportional to strain. Modulus of elasticity can be increased by low W/C ratio, rich concrete, proper curing.

4. Thermal Expansion - Concrete expands with rise in temperature and vice-versa. The change in unit length of concrete per degree temperature is known as coefficient of thermal expansion. The value is highest for quartz and lowest for lime stone. It can be controlled by providing expansion & contraction joints.