

# CONCRETE TECHNOLOGY (IV sem)

## UNIT-2

### (Part-1 Fresh Concrete and its Properties)

#### Fresh Concrete:

Fresh concrete is that stage of concrete in which concrete can be moulded into any shape and it is in plastic state. Sometimes it is also known as *Green concrete*. Fresh concrete means the wet mix of concrete before being set. The relative quantities of cement, sand, aggregates and water mixed together control the properties in the wet state.

During this time the concrete is handled, transported, placed and compacted. Properties of concrete in its fresh state are very important because they influence the quality of the hardened concrete.

#### Properties of Fresh Concrete:

1. In its fresh or green state it can be easily handled and moulded into any shape and size according to the specifications.
2. Concrete can be sprayed on and filled into fine cracks for repairs by the gunning process.
3. Concrete can be pumped and can be laid in difficult positions.
4. Fresh concrete shrinks on drying i.e. undergoes plastic shrinkage.
5. Concrete can be handled, transported, placed and compacted.
6. Consistency
7. Workability
8. Segregation
9. Bleeding
10. Laitance
11. Slump loss

## **Consistency**

Consistency of a concrete mix is a measure of the stiffness or sloppiness or fluidity of the mix. For effective handling, placing and compacting the concrete, consistency must be the same for each batch. It is therefore necessary to measure consistency of concrete at regular intervals. Slump test is commonly used to measure consistency of concrete.

Consistency is the aspect of workability related to the flow characteristics of fresh concrete. It is an indication of the fluidity or wetness of a mix and is measured by the slump test.

## **Workability**

The workability of a concrete mix is the relative ease with which concrete can be placed, compacted and finished without separation or segregation of the individual materials.

Workability is not the same thing as consistency. Mixes with the same consistency can have different work-abilities, if they are made with different sizes of stone – the smaller the stone the more workable the concrete. It is not possible to measure workability directly.

Good workability is required to produce concrete that is both economical and high in quality.

Fresh concrete has good workability if it can be formed, compacted, and finished to its final shape and texture with minimal effort and without segregation of the ingredients. Concrete with poor workability does not flow smoothly into forms or properly envelop reinforcing steel and embedded items, and it is difficult to compact and finish.

## **Plastic Shrinkage**

If water is removed from the compacted concrete before it sets, the volume of the concrete is reduced by the amount of water removed. This volume reduction is called plastic shrinkage.

Water may be removed from the plastic concrete by evaporation or by being absorbed by dry surfaces such as soil or old concrete or by the dry wooden form work.

## **Slump Loss**

From the time of mixing, fresh concrete gradually loses consistency. This gives rise to the problems only if the concrete becomes too stiff to handle, place and compact properly.

Slump loss in concrete is caused due to the following reasons:

- Hydration of cement (generating more heat)
- Loss of water by evaporation
- Absorption of water by dry aggregates
- Absorption of water by surfaces in contact with the concrete.

## Segregation

Segregation of concrete is the separation of cement paste and aggregates of concrete from each other during handling and placement. Segregation also occurs due to over-vibration or compaction of concrete, in which cement paste comes to the top and aggregates settle at the bottom.

Cement and aggregate particles have densities. In fresh concrete they consequently tend to settle and displace mixing water which migrates upward and may collect on the top surface of the concrete. Segregation of concrete affects strength and durability in structures.

Causes of Segregation of Concrete:

1. Use of high water-cement ratio in concrete.
2. Excessive vibration of concrete with mechanical needle vibrators makes heavier particles settle at bottom and lighter cement sand paste comes on top.
3. When concreting is done from height in case of underground foundations and rafts, which causes concrete to segregate.

## Bleeding

Bleeding in fresh concrete refers to the process where free water in the mix is pushed upward to the surface due to the settlement of heavier solid particles. Bleeding is one form of segregation, where water comes out to the surface of the concrete, being lowest specific gravity among all the ingredients of concrete. Bleeding can be easily identified in the field by the appearance of a thin layer of water in the top surface of freshly mixed concrete.

Bleeding occurs in concrete when coarse aggregates tends to settle down and free water rises up to the surface. This upward movement of water while traversing from bottom to top, makes continuous channels.

There are also different types of bleeding:

- Normal bleeding refers to a uniform seepage of water over the entire surface of the structure.
- Channel bleeding refers to water rising through particular paths.

Ways to reduce bleeding in concrete include:

- Reduce water content.
- Use lower slump mix
- Use finer cements
- Increase amounts of fines in the sand
- Use supplementary cementitious materials
- Use air entraining admixtures

## **Laitance**

A weak, milky layer of cement and aggregate fines on a concrete surface that is usually caused by an over-wet mixture, overworking the mixture, improper or excessive finishing or combination.

Laitance is caused by bleeding of concrete. In case of bleeding, only water accumulates at the top of the surface, but in case of laitance, along with water certain quantity of cement also comes to the surface, forming a thin layer of cement paste at the surface. This formation of cement paste at the surface is known as laitance.