

Factors Affecting Workability

1- Water content of the mix:

Mixed water is considered as the main factor affecting for the workability. In the case of maximum size of aggregate decrease (surface area increasing) the quantity of needed water increasing in order to have a specific workability.

2- Relative amount of cement paste:

Decreasing cement paste means difficult workability, while increasing the amount of cement paste make the mix more liquidity means increasing in workability. If the paste is not sufficient for filling the voids between aggregates, the mix become dry, means loses its workability.

3-Cement fineness:

The increasing in fineness increasing the workability because the surface area increases.

4- Grading of aggregate:

It is necessary that the aggregate grading mix between (gravel and sand) to give a maximum density with a specific amount of done work so that the fresh concrete have good workability and the hardened concrete have high strength.

5- Shape of aggregate particles:

When the aggregate particles have high surface area the workability of the mixture decreases like in elongated and flaky particles because they are required more amount of water to wet their surfaces in order to reach a good workability of concrete. Spherical or rounded particles have a low surface area, therefore less amount of water required means high workability.

Irregular particles required high amount of cement to reach a specific amount of workability.

6-texture Surface:

Increases the surface roughness of aggregates → reduce movement in the mixture → increase internal friction → reduce the workability.

7- Using of additives and admixtures:

There are some chemicals with high fineness added to the mixture to decrease the friction and improve the workability like:

- 1.Silica fume
2. crushed lime stone
3. rice husk ash

8- Air entering admixtures :

They are chemical materials have the ability to introduce spherical air bubbles. These bubbles will increase the workability. By using these materials we can decrease the water content of the mixture.

9- Time and temperature :

Workability will decrease with time because the water consumed due to several factors :-

- 1- Some water from the mix is absorbed by the aggregate
- 2- Reaction between cement and water
- 3- Some is lost by evaporation, particularly if the concrete is exposed to sun or wind

- Increasing the temperature → Increase the rate of hydration and evaporation
→ loss of workability.

Segregation

Segregation can be defined as separation of the constituents of a heterogeneous mixture so that their distribution is no longer uniform.

Causes of segregation:

- 1- Differences in the size of particles and in the specific gravity of the mix.
- 2- Method of handling and placing of concrete.
- 3- Dropping concrete from high places.
- 4- The method of casting: concrete should always be placed direct in the position in which it is to remain and must not be allowed to flow along the mold.
- 5- Method of compaction: compaction of concrete for a long time causes segregation.

Types of segregation :

- 1- The coarser particles tend to separate out because they tend to travel further along a slope or to settle more than finer particles.
- 2- The second form of segregation is the segregation of cement paste from the mixture occurring particularly in wet mixes.

How to decrease occurring of segregation:

1. Using a suitable water content and do not use dry mixtures.
2. The choice of suitable grading: using aggregate particles within a similar specific weight.
3. Segregation can be greatly reduced by using correct method of handling, transporting and placing.
4. Concrete should be placed direct in the position in which it is to remain and must not be allowed to flow or to be worked along the form.
5. Using entrained air reduces segregation.

Bleeding

Is a form of segregation in which some of the water in the mix tends to rise to the surface of freshly placed concrete. This is caused by the inability of the solid parts of the mix to keep all mixing water.

Effects of bleeding on concrete:

- 1- If the concrete is casting in layers then a weak levels will be created between these layers.
- 2- If evaporation of water from the surface of the concrete is faster than the bleeding rate, plastic shrinkage cracking may result.
- 3- Some of the rising water will restricted under the aggregate particles and steel reinforcement which cause some leak points in the bonding.
- 4- Rising water take some fine particles of cement creating a layer of laitance which must be removed for its weakness. Also this process maybe causes small open channels inside the body of concrete mixture which may lead to decrease its strength.

Factors effecting on the bleeding :

- 1- Physical properties for cement and fine aggregate: Bleeding is decreased by increasing the fineness of cement.
- 2- Bleeding may decrease by adding some alkalis and C_3A in cement or when adding $CaCl_2$.
- 3- Mixes rich with cement content had less tendency to bleed than poor mixes because water move from aggregate to cement in order to react.
- 4- Adding pozzolanic materials and air entraining admixtures will decrease bleeding of the concrete.