CONCRETE TECHNOLOGY

تكنلوجيا الخرسانة 2

المرحلة الثالثة

Asst. Lec. Nora AL-Anssari

Lecture 2

Fresh Concrete

FRESH CONCRETE

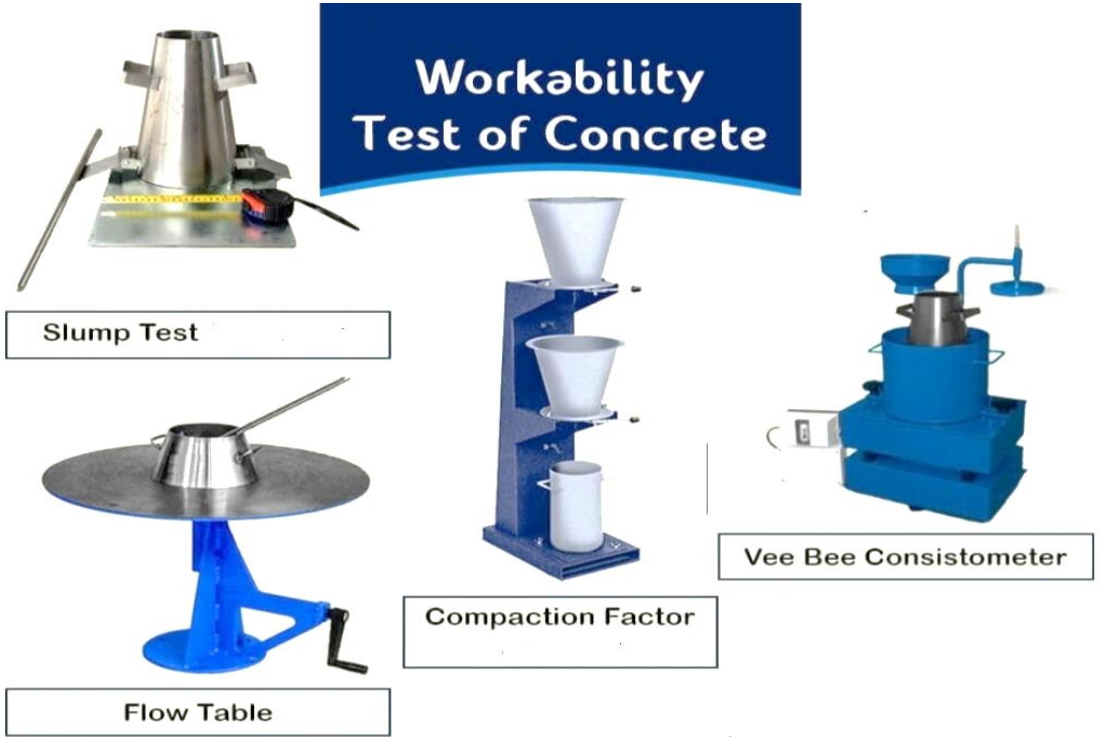
Fresh concrete refers to the concrete in its plastic or unhardened state, It is the concrete phase from mixing and before it sets. in which concrete can be moulded, Understanding its properties is crucial because they influence the ease of handling, transportation, placing, and compaction, which ultimately affect the hardened concrete's strength and durability.

PROPERTIES OF FRESH CONCRETE

1. ***Workability of Concrete*** is the ease with which fresh concrete can be mixed, placed, and compacted without excessive bleeding or segregation.

Measurements of workability:

1. Slump Test
2. Compacting Factor Test
3. Flow Table Test
4. V-B Test



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 :

Decreasing cement paste means difficult workability, while increasing the amount of cement help improve cohesion and bonging between particles means increasing workability.

3-Cement fineness:

The increase in fineness increases 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 a high surface area, the workability of the mixture decreases like in elongated and flaky particles. Spherical or rounded particles have a low surface area, therefore less amount of water required means high workability.

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

6-texture Surface:
Increases in the surface roughness of aggregates reduce movement in the mixture increase internal friction reduce 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 limestone
3. rice husk ash

8- Air entering admixtures :
They are chemical materials that can 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.

2. Consistency is sometimes taken to mean the fluidity or wetness of the concrete mix, closely related to workability, wet concretes are more workable than dry concrete, but concrete of same consistency may vary in workability.

Measurement: Slump test (high slump = high consistency).

The consistency of concrete can be classified to:

- **Dry consistency**: The amount of water is very low in the mixture and it is enough only for bonding cement particles with aggregate.
- **Stiff consistency**: the water mixed is more than that required for bonding cement particles with aggregate in the mix.
- **Medium or plastic consistency**.
- **Wet consistency**.
- **Sloppy consistency**.

220-180	200-100	120-30	40-10	20-0	الهطول (mm)
رخو Sloppy	مبتل Wet	لدن Plastic	صلب Stiff	جاف Dry	قوام الخلطة الخرسانية (Consistency)

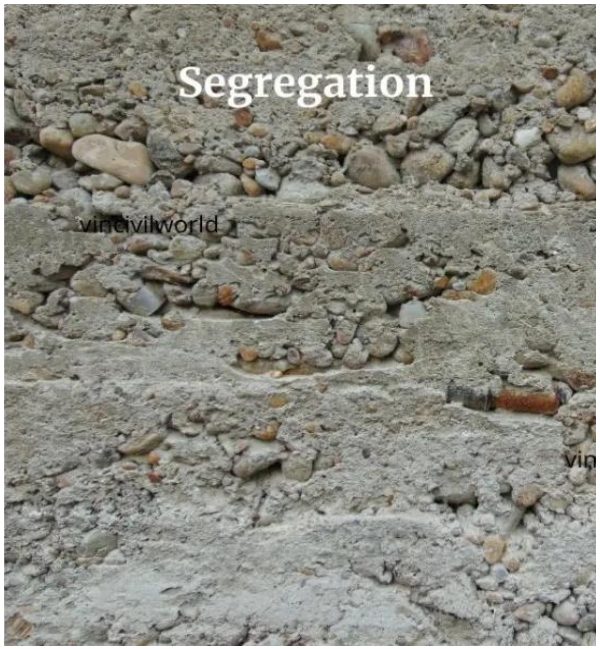
3.Cohesiveness - Segregation and Bleeding

Segregation and bleeding are two undesirable phenomena that affect the quality and durability of fresh concrete. Both issues occur due to improper mix proportions, handling, or placement of concrete.

A)SEGREGATION – refers to the separation of the concrete ingredients during handling, transportation, or placement. It can lead to an uneven distribution of materials, resulting in weak spots in the concrete structure.

Segregation may be of three types:

1. Coarse aggregate separating out or settling down from the rest of the matrix.
2. Paste separating away from coarse aggregate.
3. Water separating out from the rest of the material being a material of lowest specific gravity



Effects of Segregation on concrete:

- Weak zones or honeycombing in the concrete.
- Reduced strength and durability.
- Non-uniform appearance

Causes of segregation:

1- Improper Mix Proportions: Too much coarse aggregate or insufficient fine material.
2- Differences in the size of particles and in the specific gravity of the mix.
3- Over-Vibration or improper compaction
4- Method of handling and placing of concrete.
5- 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.

How to decrease occurring of segregation:

1. Proper mix design with suitable water water-cement ratio.
2. The use of well-graded aggregates.
3. Segregation can be greatly reduced by using correct method of handling, transporting and placing.




B) BLEEDING – refers to the upward movement of water to the surface of the concrete after placement. This happens when excess water in the mix rises due to the settlement of solid particles (cement and aggregates).

Effects of Bleeding on concrete:

•Formation of Water Pockets: These can weaken the concrete by reducing the bond between cement paste and aggregates.

•Weak Top Layer: Excess water at the surface can lead to a weaker surface layer that is prone to cracking, dusting, and reduced durability.

•Delayed Finishing: Bleeding water must evaporate before finishing, causing delays.

Causes of bleeding:

1.High Water-Cement Ratio: A high water-cement ratio increases the likelihood of bleeding as it provides more free water to segregate from the mix.

2.Improper Aggregate Gradation: If the aggregate used in the mix is not properly graded, it can lead to increased bleeding.

3.The absence of fine particles creates voids, allowing water to rise.

4. Inadequate use of Admixtures**:** Certain admixtures, if not used correctly, can increase the rate of bleeding.

How to decrease occurring of bleeding:

1- Bleeding can be reduced by the use of finer cement or cement.

2- Bleeding may decrease by adding some alkalis and C3A in cement or when adding $CaCl_2$.

3- Mixes rich in cement content are less susceptible to bleeding than lean mixes because water moves from aggregate to cement in order to react.

4- Adding pozzolanic materials and air-entraining admixtures will decrease the bleeding of the concrete.

5- Bleeding can be reduced by proper proportioning and uniform and complete mixing.

*4. **Setting of concrete*** refers to the process by which fresh concrete transitions from a plastic state to a hardened state. This occurs due to the hydration reaction between cement and water. The setting process is divided into two phases:

•**Initial Setting Time**: The time taken for concrete to lose its plasticity and begin to harden. During this period, the concrete can still be worked or molded.

•**Final Setting Time**: The time at which concrete fully solidifies and cannot be worked or reshaped anymore.

Both the initial and final setting times are crucial for ensuring that the concrete can be transported, placed, and compacted before it hardens.

Other Related Terms

1. False Setting:

A premature stiffening of concrete that seems like setting but can be reversed by re-mixing. Caused Often due to improper storage of cement or hydration of certain cement compounds (like gypsum).

2. Flash Setting:

A rapid and permanent setting of concrete that occurs shortly after mixing, without the possibility of reworking. Caused by insufficient gypsum in the cement, leading to uncontrolled hydration of cement compounds, particularly C3A (Tricalcium Aluminate).

Both terms refer to abnormal setting behaviors that can cause issues if not managed correctly.


HAVE ANY
QUESTIONS AND DOUBTS