

## ***Fresh Concrete***

### ***Introduction:***

The main materials are used in engineering construction are 1- concrete 2- steel, and sometimes they complete each other.

***Fresh Concrete:*** It is a freshly mixed concrete and it does not set yet.

***Green Concrete:*** it is a fresh concrete set after it loses its plasticity gradually.

***Hardened Concrete:*** It is a green concrete hardened and have the strength to resist the loads affecting the structure.

**\* There are two sets of criteria that we must consider when making concrete:**

- 1) Long term requirements of hardened concrete, such as strength, durability, and volume stability.
- 2) Short term requirements like workability.

**\* Fresh concrete properties controlled by:**

- 1) The nature of the concrete structure
- 2) The shape of the mold and its arrangement, and the density of Reinforcement.

**\* The strength of concrete is effected by:**

- 1) The degree of compaction.
- 2) Caring and protecting concrete during transportation, casting, compacting, and finishing.

**To obtain concrete of high quality and resistance, the following conditions must be met for soft concrete: -**

- 1- Fresh concrete should be easy to mix and transport.
- 2- Easy casting and compaction of the concrete soft without the use of additional energy.
- 3- The separation of particles shall not take place during the pouring or compaction of concrete.

4- The concrete must be homogeneous.

### **Main Properties of Fresh Concrete:**

1. Consistency.
2. Workability.
3. Segregation.
4. Bleeding.

### **Consistency of concrete:**

It represents to the degree of moisture and wet of concrete, the purpose of determining the consistency of the concrete is to get confirmation that the mixed concrete has workability for all types of concrete.

### **The consistency of concrete can be classified to:**

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

### **Workability:**

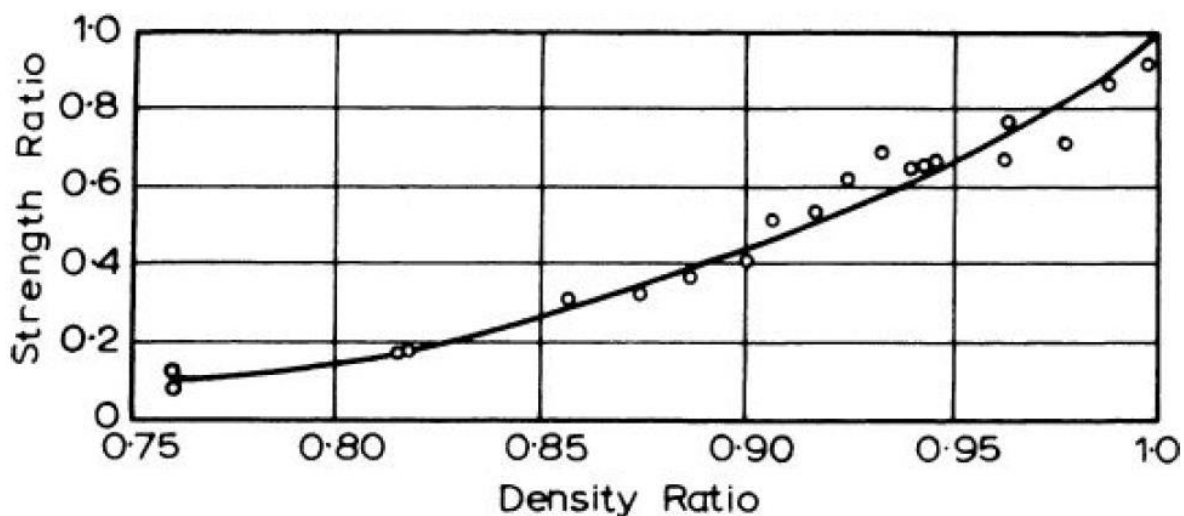
If a concrete satisfy the conditions of being transported, casting, well compacting, and finished sufficiently without segregation, it said to be workable.

In other words workability determines the ease of placement and the resistant of segregation.

The workability depends on the method of compacting to dispose the trapped air from the concrete by:

- 1) Vibration method
- 2) Manual compacting

- *The total energy required for full compaction = useful work + wasted work*
- Concrete must have a workability such that compaction to maximum density is possible with a reasonable amount of work or with the amount that we are prepared to put in under given conditions.
- The presence of voids in concrete greatly reduces its strength: 5 % of voids can lower strength by as much as 30 %, and even 2 % voids can result in a drop of strength of more than 10 % as shown in figure (1).



**Figure (1): Relation between strength ratio and density ratio**

- **Voids in concrete are classified into:-**

- 1- Bubbles of entrapped air.
  - 2- Spaces left after excess water has been removed, the volume of the latter depends primarily on the water/cement ratio of the mix.
- For any given method of compaction there may be optimum water content of the mix at which the sum of the volumes of air bubbles and water space will be a minimum. At this optimum water content, the highest density ratio of the concrete would be obtained.

**Workability is measure for the following characteristics:**

- 1- **Mobility:** it is the ability of freshly mixed concrete or mortar to flow into mold and around reinforcement.
- 2- **Stability:** it's referring to the cohesion of the mix, that is, its resistance to segregation.
- 3- **Compatibility:** it is the compaction of concrete easily and removing the air voids.

**Measurements of workability:**

**1- Slump test**

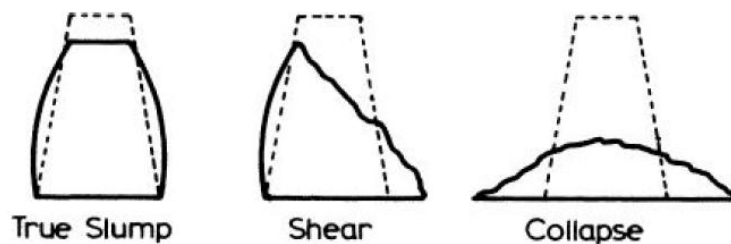
This is a test used extensively in site work all over the world. The slump test does not measure the workability of concrete but the test is very useful in:

- 1- Moisture content of aggregate has unexpectedly increased.
  - 2- Change in the grading of the aggregate, such as a deficiency of sand.
- **Slump:** The decrease in the height of the slumped concrete.

- **There are three classifications of slump:-**

- 1- **True slump:** Is a general reduction in height of the mass without any breaking.
- 2- **Shear slump:** indicates to the lack of cohesive of the mixture.

**3- Collapse slump:** Generally indicates a very wet mix with different aggregate or mix proportion.

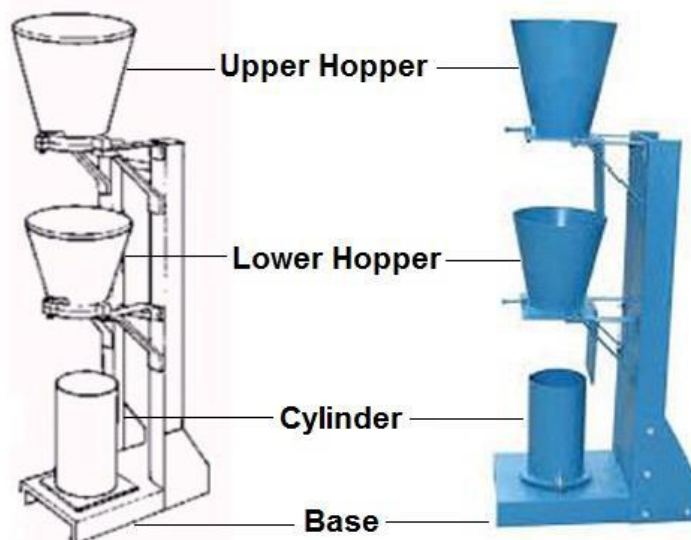


**Figure (2): The types of slump**

## 2- Compacting factor test

The degree of compaction, called the compacting factor, is measured by the density ratio, i.e. the ratio of the density actually achieved in the test to the density of the same concrete fully compacted.

The apparatus of compaction factor test is shown in figure (3)



**Figure (3): compaction factor apparatus.**

$$\text{Compaction factor} = \frac{\text{the density of concrete partially compacted}}{\text{the density of concrete fully compacted}}$$

**3- Remolding test**

**4- V-B test.**