

## Compaction of concrete

- \* The process of compaction consists essentially of elimination of entrapped air.
- \* With elimination of entrapped air, optimum density with maximum strength would be obtained.
- \* With increasing voids ratio, density is reduced and hence, the strength decreased. The presence of (5%) voids decreases compressive strength by (30%).
- \* Compaction of concrete for a long time causes segregation which lead to weakening concrete and formation of laitance on the surface of the concrete.

### The purposes of concrete compaction:

- 1- Reduce the air voids.
- 2- Increase bonding capacity between concrete compounds (aggregate and cement, and between cement and reinforcement).
- 3- Increase the compressive strength of concrete.
- 4- Increase the density of concrete.
- 5- Reduce the degree of absorption and increase the strength of concrete strength of weathering.
- 6- Reduce the volumetric changes.

### Methods of compaction:

- 1- Ramming:** using steel road. This method is not useful for dry mixes (compacting factor below 0.75). It is usually used for wet mixes (mixes with wet consistency) and high workability.
- 2- Mechanical method:** suitable for dry mixes by using vibrator. Mechanical method do not used for wet mixes as they cause segregation.

## Types of vibrators:

**1- Internal vibrators:** This is the most common vibrators it is easily moved from place to place, and is applied at 0.5 to 1 m for 5 to 30 seconds, depending on the consistency of the mix.



**2- External Vibrators:** This type of vibrator is rigidly clamped to the formwork resting on an elastic support, so that both the mold and the concrete are vibrated.

- External vibrators are used for precast or thin in site sections.
- These vibrators are effective for concrete sections up to 600 mm.



**3- Vibrating tables:** This can be considered as a case of formwork to the vibrator but the principle of vibrating the concrete and formwork together.

**Hot weather concreting:**

There are some special problems involved in concreting in hot weather:

- 1- Increasing the rate of evaporation from the fresh mix.
- 2- Increasing the temperature in concrete itself.

The increasing of the rate of evaporation occurs due to rise in temperature and decreasing in relative humidity.

**Effects of hot weather on concrete properties:**

- 1- Rapid hydration of cement.
- 2- Plastic shrinkage cracking.
- 3- Lower long-term strength of concrete.

**وقاية الخرسانة من الاجواء الحارة: Prevention of hot weathering concreting:**

- 1- Reduce the cement content in the mixture to reduce the heat of hydration or use low heat cement or use additives like blast furnace slag or pozollana.
- 2- The use of additives that slow down freezing and additives that reduce water.
- 3- Reduce the temperature of the fresh concrete by cooling one or two from concrete constituents, like cooling water and use ice.

It can calculate the concrete temperature after mixing by using the following relation:

$$T = \frac{0.22(T_a W_a + T_c W_c) + T_w W_w}{0.22(W_a + W_c) + W_w}$$

Where:

$W_a$ ,  $W_c$ ,  $W_w$ : The weight of aggregate, cement, and water in the mix.

$T_a$ ,  $T_c$ ,  $T_w$ : The temperature of the components of mix aggregate, cement, and water.

$T$ : Temperature of the freshly mixed concrete ( $^{\circ}\text{C}$ ,  $^{\circ}\text{F}$ ).

• **It is necessary to pay attention to some observations during the steps of making concrete in hot weather:**

1- It is preferable that the temperature of the used cement does not exceed 75 ° C, because if the hot cement is moistened with a small amount of water before mixing it with the solid components of the concrete, it may freeze quickly and clump in the form of cement balls.

2- After pouring concrete, it must be protected from the sun, otherwise cracks may occur when the weather is cold at night due to the temperature difference.

3- Do not allow water to evaporate when treating concrete in hot weather to avoid cracks.

**Ready mixed concrete**

Concrete is made ready in the central factory then transported to the work site.

Ready-mixed concrete is particularly useful on:

1- Congested sites or in road construction where little space for a mixing plant and for extensive aggregate stockpiles is available

2- The use of ready-mixed concrete is also advantageous when only small quantities of concrete are required or when concrete is placed only at intervals.

**Benefits of Ready mixed concrete:**

1- It is made under better conditions of control.

2- Reduce the responsibility of the supervisors on the site.

3- Although the high cost of ready mixed concrete but it will be high quality control and high site organizer.