Segregation

Segregation can be defined as the separation of the constituent materials of concrete. A good concrete is one in which all the ingredients are properly distributed to make a homogeneous mixture. If a sample of concrete exhibits a tendency for separation such concrete is not only going to be weak; lack of homogeneity is also going to induce all undesirable properties in the hardened concrete but it can be controlled by the choice of suitable grading and care in handling.

There are considerable differences in the sizes and specific gravities of the constituent ingredients of concrete. Therefore, it is natural that the materials show a tendency to fall apart. Segregation may be of two types: firstly (in too dry mixes), the coarse aggregate separating out or settling down from the rest of the matrix, secondly (in too wet mixes), the paste or matrix separating away from coarse aggregate. if segregation is observed, remixing for a short time would make the concrete again homogeneous.

- **Causes of segregation :**
  - Transporting concrete mixes for long distance
  - Badly proportioned mix where sufficient matrix is not there to bind the aggregates
  - Dropping concrete from height places.
  - Vibrating concrete for long time.

the tendency for segregation can be remedied by correctly proportioning the mix, by proper handling, transporting, placing, compacting and finishing , using air entraining admixture and pozzolanic materials, and choosing coarse and fine aggregate with approach specific gravity.

Bleeding

Bleeding is sometimes referred as water gain. It is a particular form of segregation, in which some of the water from the concrete comes out to the surface of the concrete, being of the lowest specific gravity among all the ingredients of concrete. Bleeding is predominantly observed in a highly wet mix, badly proportioned and insufficiently mixed concrete. In thin members like roof slab or road slabs and when concrete is placed in sunny weather show excessive bleeding Due to bleeding, water comes up and accumulates at the surface. Sometimes, along with this water, certain quantity of cement also comes to the surface. When the surface is worked up with the trowel and floats, the

aggregate goes down and the cement and water come up to the top surface. This formation of cement paste at the surface is known as “Laitance”.

Water while traversing from bottom to top, makes continuous channels. If the water cement ratio used is more than 0.7, the bleeding channels will remain continuous and un segmented by the development of gel. These continuous bleeding channels are often responsible for causing permeability of the concrete structures.

While the mixing water is in the process of coming up, it may be intercepted by aggregates. The bleeding water is likely to accumulate below the aggregate. This accumulation of water creates water voids and reduces the bond between the aggregates and the paste. The above aspect is more pronounced in the case of flaky aggregate. Similarly, the water that accumulates below the reinforcing bars, particularly below the cranked bars, reduces the bond between the reinforcement and the concrete. The poor bond between the aggregate and the paste or the reinforcement and the paste due to bleeding can be remedied by re vibration of concrete.

The bleeding is not completely harmful if the rate of evaporation of water from the surface is equal to the rate of bleeding which increase strength.

- **How to reduce bleeding**
  - Proper proportioning and uniform and complete mixing.
  - Use of finely divided pozzolanic materials and air-entraining agent
  - Use of finer cement or cement with low alkali and high C_3A content.
  - Use Rich mixes which are less susceptible to bleeding.

Mixing of concrete

Thorough mixing of the materials is essential for the production of uniform concrete. The mixing should ensure that the mass becomes homogeneous, and consistency. There are two methods adopted for mixing concrete:

a) Hand Mixing

Hand mixing is practiced for small scale unimportant concrete works. As the mixing cannot be thorough and efficient, Hand mixing should be done over an impervious concrete or brick floor of sufficiently large size to take one bag of cement. Spread out the measured quantity of coarse aggregate and fine aggregate in alternate layers. Pour the cement on the top of it, and mix them dry by shovel, turning the

mixture over and over again until uniformity of colour is achieved. Water is taken in a water can fitted with a rose head and sprinkled over the mixture and simultaneously turned over. This operation is continued till such time a good uniform, homogeneous concrete is obtained. It is of particular importance to see that the water is not poured but it is only sprinkled. Water in small quantity should be added towards the end of the mixing to get the just required consistency.

b) Machine mixing

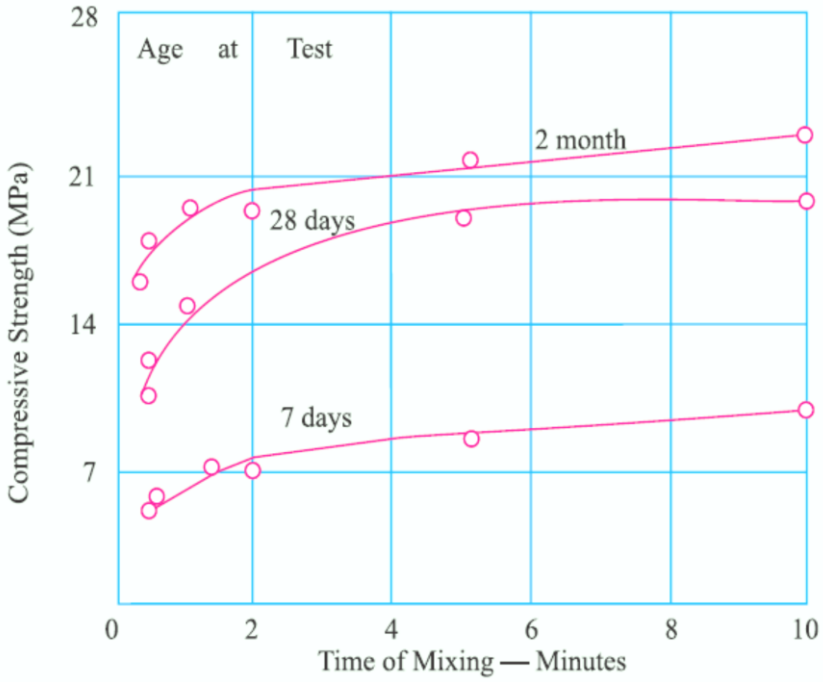
Mixing of concrete is almost invariably carried out by machine, for reinforced concrete work and for medium or large scale mass concrete work. Machine mixing is not only efficient, but also economical, when the quantity of concrete to be produced is large. Many types of mixers are available for mixing concrete

- **Tilting Mixer**: - usually have conical shaped drums with vanes inside. The discharge action is always good as all the concrete can be tipped out rapidly with un segregated mass for this reason these mixers are used for mixes with low workability and those with large size aggregate.
- **Non- Tilting Mixer:-** Consists of a cylinder round about fixed horizontal axis . the materials feeding from one end and discharging concrete from the other end. The discharging operation is low so the mixes tend to segregate. For this reason it preferred to use with small size aggregate mixes.
- **Pan Mixers:-** the mixes consist essentially of a circular pan rotated about its axis with one or two star paddles rotating about vertical axis not coincident with the axis of the pan. Pan mixers are efficient with stiff and cohesive mixes and are , therefore, often used in the manufacture of precast concrete. They are also suitable, because of scraping arrangement, for mixing small quantities of concrete.
- **Drum Type mixer:-** in these mixes there is no scraping of the side take place during mixing so that a certain amount of mortar adheres to the side of the drum and stay there until the mixer has been cleaned. It follows that at the beginning of concreting the first mix would leave a large proportion of its mortar behind so the initial batch should be discharge. As an alternative, a certain amount of mortar may be introduced into the mixer prior to commencement of concreting.
- **Dual Drum mixers:** there are two drums in series, concrete been mix part of the time in one and then transferred to the other for the reminder of mixing time and finally discharge. In the mean time the first drum is recharged and initial

Mixing take place. In this manner the yield of concrete can be double compared with ordinary mixer with same batching equipment. it used for road construction.

Mixing time

Concrete mixers are generally designed to run at a speed of 15 to 20 revolutions per minute. In the site, the normal tendency is to speed up the outturn of concrete by reducing the mixing time. This results in poor quality of concrete. On the other hand, if the concrete is mixed for a comparatively longer time, it is uneconomical from the point of view of rate of production of concrete and fuel consumption. Therefore, it is of importance to mix the concrete for such a duration which will accrue optimum benefit. It is seen from the experiments that the quality of concrete in terms of compressive strength will increase with the increase in the time of mixing, but for mixing time beyond two minutes, the improvement in compressive strength is not very significant.



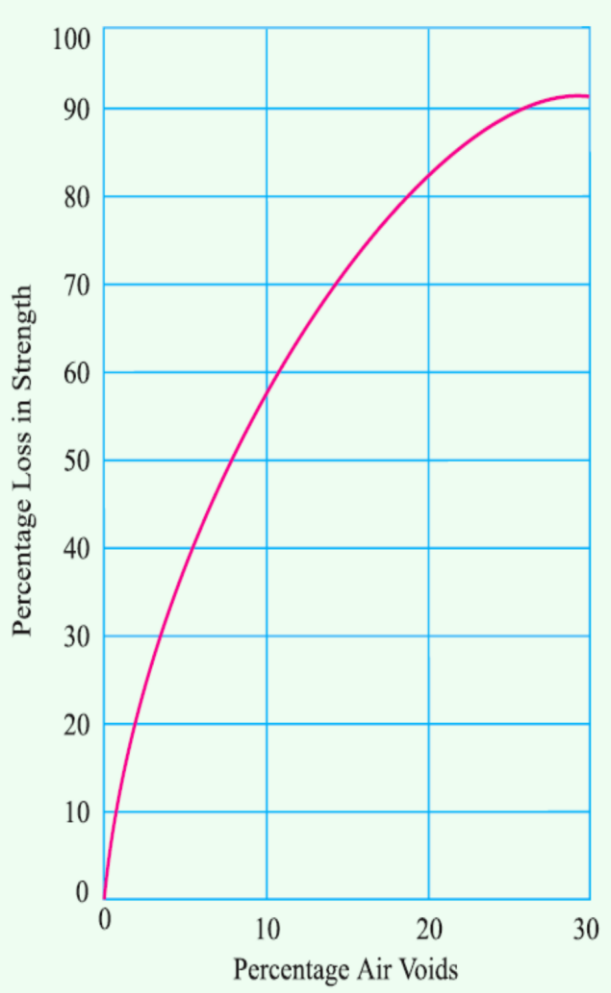
Due to mixing over long periods, the effective water/cement ratio gets reduced, owing to the absorption of water by aggregate and evaporation. It is also possible that the increase in strength may be due to the improvement in workability on account of excess of fines, resulting from the abrasion and attrition of coarse aggregate in the mix, and from the coarse aggregates themselves becoming rounded. The above may not be true in all conditions and in all cases. Sometimes, the evaporation of water and formation of excess

fines may reduce the workability and hence bring about reduction in strength. The excess of fine may also cause greater shrinkage.

Compaction of concrete

Compaction of concrete is the process adopted for expelling the entrapped air from the concrete. In the process of mixing, transporting and placing of concrete air is likely to get entrapped in the concrete. The lower the workability, higher is the amount of air entrapped. In other words, stiff concrete mix has high percentage of entrapped air and, therefore, would need higher compacting efforts than high workable mixes.

Insufficient compaction increases the permeability of concrete resulting in easy entry for aggressive chemicals in solution, which attack concrete and reinforcement to reduce the durability of concrete also decrease the compressive strength on concrete.



Internal Vibrator: the internal vibrator is most commonly used. This essentially consists of a power unit, a flexible shaft and a needle. The vibrations are caused by eccentric weights attached to the shaft or the motor or to the rotor of a vibrating element. Electromagnet, pulsating equipment is also available. The frequency of vibration varies up to 12,000 cycles of vibration per minute. The bigger needle is used in the construction of mass concrete dam. Sometimes, arrangements are available such that the needle can be replaced by a blade of approximately the same length. This blade facilitates vibration of members, where, due to the congested reinforcement, the needle would not go in, but this blade can effectively vibrate. They are portable and can be shifted from place to place very easily during concreting operation. They can also be used in difficult positions and situations.

External Vibrator: Formwork vibrators are used for concreting columns, thin walls or in the casting of precast units. The machine is clamped on to the external wall surface of the formwork. The vibration is given to the formwork so that the concrete in the vicinity of the shutter gets vibrated. This method of vibrating concrete is particularly useful and adopted where reinforcement, lateral ties and spacers interfere too much with the internal vibrator.

Table Vibrator: This is the special case of formwork vibrator, where the vibrator is clamped to the table or table is mounted on springs which are vibrated transferring the vibration to the table. They are commonly used for vibrating concrete cubes. Any article kept on the table gets vibrated. This is adopted mostly in the laboratories.

Hand Compaction: Hand compaction of concrete is adopted in case of unimportant concrete work of small magnitude. Sometimes, this method is also applied in such situation, where a large quantity of reinforcement is used, which cannot be normally compacted by mechanical means. Hand compaction consists of rodding, ramming or tamping. When hand compaction is adopted, the consistency of concrete is maintained at a higher level.

And there are many other vibrators uses for special purposes such as surface vibrators, electric hammer, vibrating rollers … etc .