

Concrete

Lecture - 1

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Summary

Properties of concrete



The characteristics and qualities which deals with the study and nature of concrete are known as properties of concrete.

Objectives of studying the properties of concrete

To prevent bleeding and segregation in order to avoid the formation of cracks

To choose correct W/C ratio in order to increase the strength

To maintain the workability and durability of concrete

To design a proportionate mix

To make concrete impermeable

Properties of concrete



Concrete has to pass through two stages before it is used as structural member

Stage of Concrete

Plastic Stage

Good Workability

Freedom from segregation

Freedom from bleeding

Hardened stage

Strength

Durability

Impermeability

Dimensional Changes

Properties of concrete in Plastic Stage

In Plastic stage concrete should have

Good
Workability

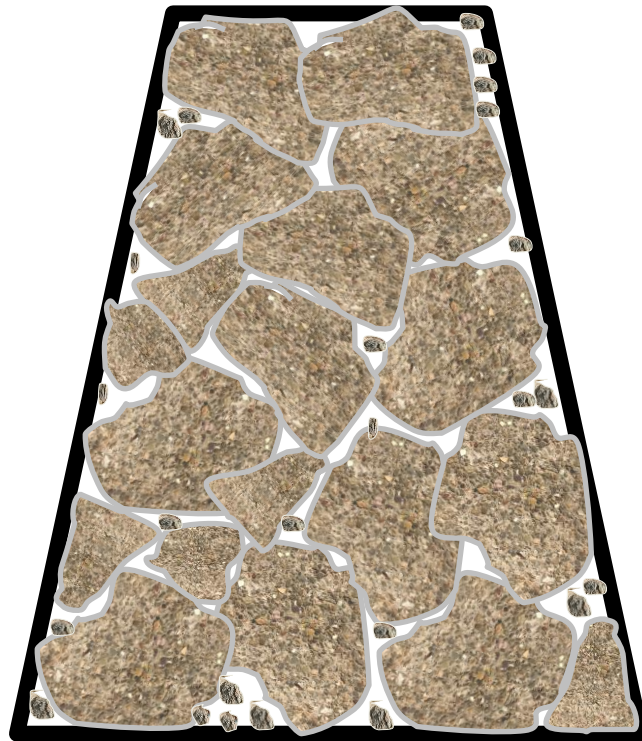
Freedom from
segregation

Freedom from
Bleeding

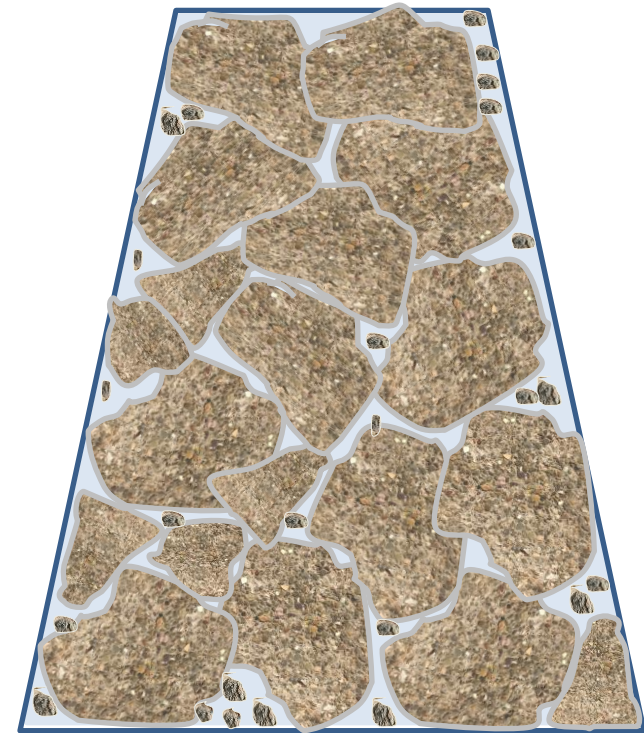
Good Workability

Workability in simple term can be defined as "the ease with which the concrete can be mixed, transported, place and compacted". A workable concrete does not result in bleeding or segregation.

Harsh Concrete/Unworkable

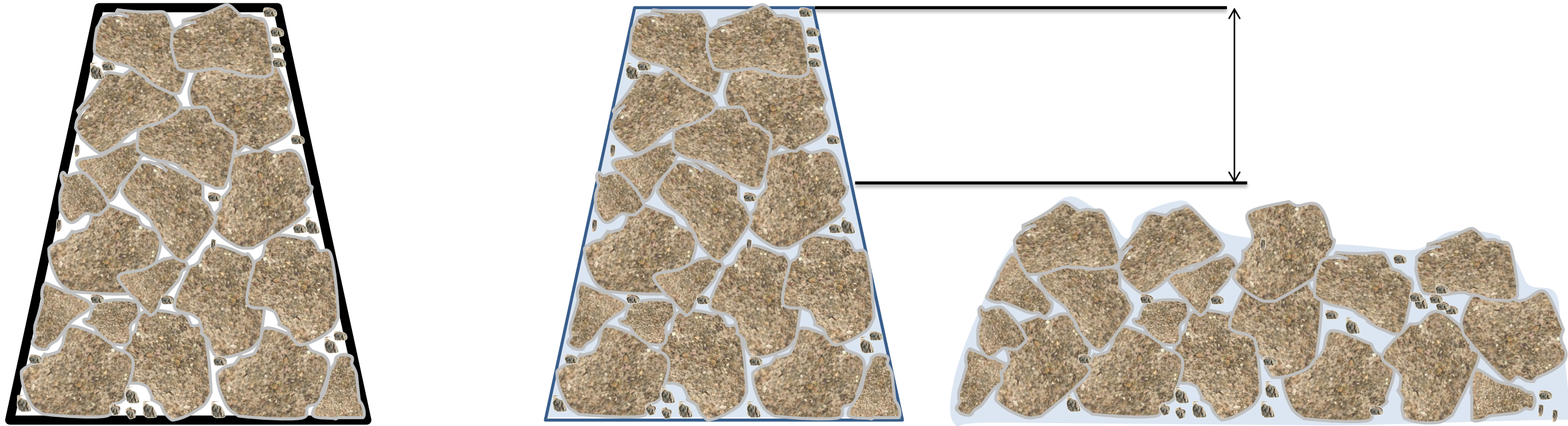


STAGE I

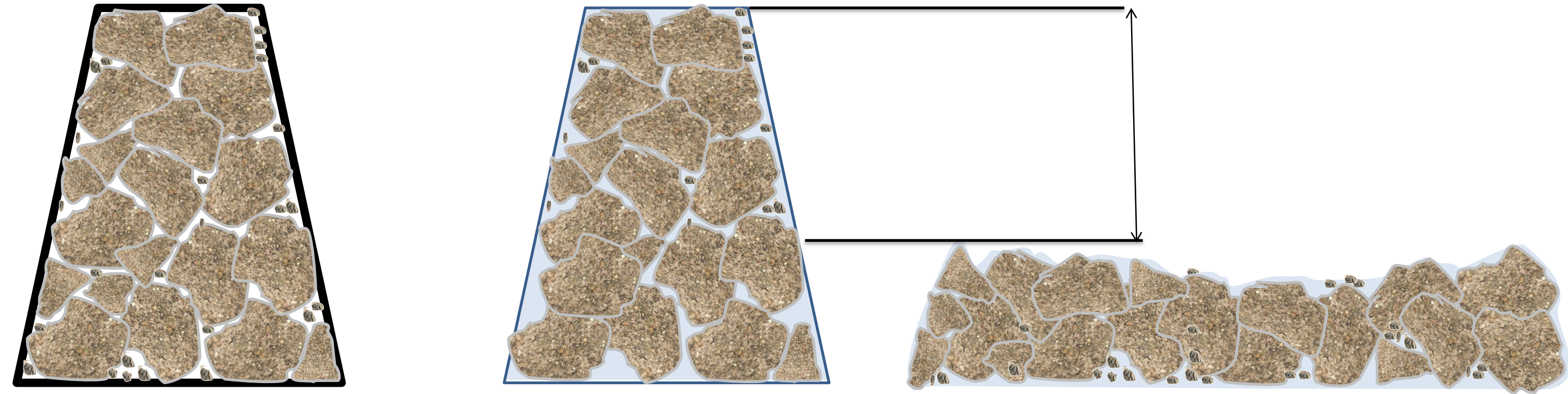


STAGE II

Medium Workability



High Workability



Factors affecting Workability



Workable concrete is the one which exhibits very little internal friction between particle and particle or which overcomes the frictional resistance offered by the formwork surface or reinforcement contained in the concrete with just the amount of compacting efforts forthcoming. The factors helping concrete to have more lubricating effect to reduce internal friction for helping easy compaction are given below:

Water Content

Workability is largely depend upon its water content. With the increase of water, the workability also increased. But too much water results into concrete of low strength and poor durability.

Factors affecting Workability



Mix Proportions

Aggregate/cement ratio is an important factor influencing workability. The higher the aggregate/cement ratio, the leaner is the concrete. In lean concrete, less quantity of paste is available for providing lubrication, per unit surface area of aggregate and hence the mobility of aggregate is restrained. On the other hand, in case of rich concrete with lower aggregate/cement ratio, more paste is available to make the mix cohesive and fatty to give better workability.

Factors affecting Workability



Shape of Aggregate

Workability increases with round and smooth surface aggregates. Crushed or angular aggregates has less workability because of higher and rough surface area.

Grading of Aggregate

This is one of the factors which will have maximum influence on workability. A well graded aggregate is the one which has least amount of voids in a given volume.

Factors affecting Workability



Other factors being constant, when the **total voids are less, excess paste is available to give better lubricating effect.** With **excess amount of paste**, the mixture becomes **cohesive and fatty** which **prevents segregation of particles.** Aggregate particles will slide past each other with the least amount of compacting efforts. The better the grading, the less is the void content and higher the workability. The above is true for the given amount of paste volume.

Factors affecting Workability



Porosity and Absorption of Aggregate

Porous and non-saturated aggregate will require more water than a **non-porous and saturated aggregate**. For same degree of workability, the latter will require less quantity of water.

Admixture

Workability also increases with the addition of admixture such as air entraining agents (e.g. vinsol resin) which produce well dispersed air bubbles. These bubbles act as rollers thus increasing the workability but of course reduce the strength.

Factors affecting Workability



Mixing Time

With the increase in mixing time up to certain limit (Say 2 minutes), workability increases.

Temperature

The slump of the concrete mix decreases as the temperature of the mix increases. Thus the normal temperature helps in the improvement of workability of concrete

Factors affecting Workability



Surface Texture:

The influence of surface texture on workability is again due to the fact that the total surface area of rough textured aggregate is more than the surface area of smooth rounded aggregate of same volume. From the earlier discussions it can be inferred that *rough textured aggregate will show poor workability and smooth or glassy textured aggregate will give better workability*. A reduction of inter particle frictional resistance offered by smooth aggregates also contributes to higher workability.

Summary



- ✓ Introduction of Concrete
- ✓ Properties of concrete in Wet state
- ✓ Factors affecting Workability

THANK YOU