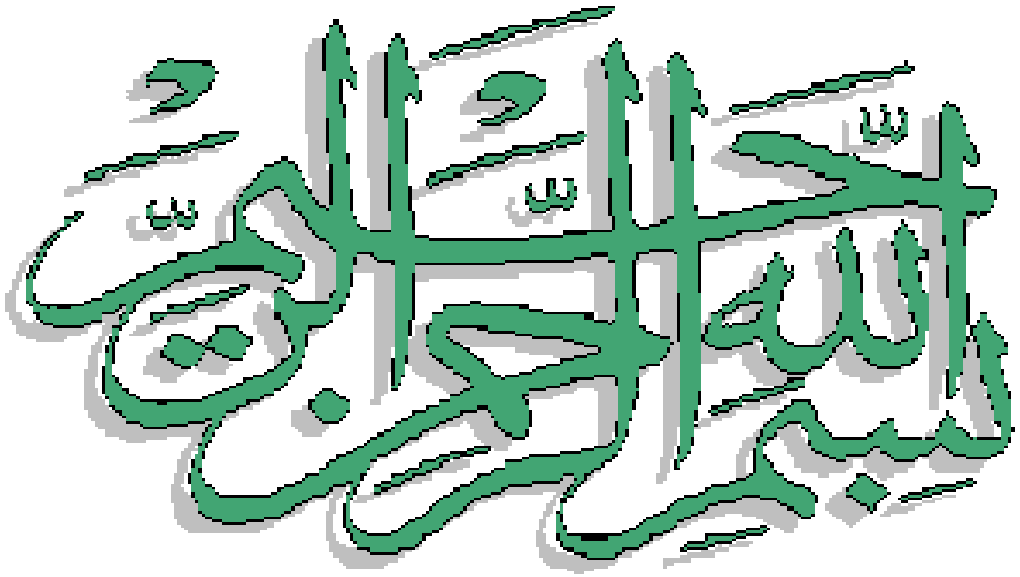


In the name of Allah, the most beneficent and most merciful

CE-106 Civil Engineering Materials and Concrete Technology

Admixtures

Common Admixture to the Concrete Mix and What They Do

In concrete, a substance other than active and inert matter, added in small quantities to the mix to alter its properties.

Admixtures are additions to the mix used to achieve certain goals.

Here are the main admixture and what they aim to achieve.

Admixtures Cont…

Accelerating admixture:

Accelerator is added to concrete to reduce setting time of the concrete and to accelerate early strength. The amount of reduction in setting time varies depending on the amount of accelerator used.

Calcium chloride is a low cost accelerator, but specification often calls for a non-chloride accelerator to prevent corrosion of reinforcing steel.

Admixtures Cont…

Retarding admixtures

Are often used in hot weather conditions to delay setting time. Many retarders also act as a water reducer.

Fly Ash----A by -product of coal burning plants. Fly ash can replace 15%-30% of the cement in the mix. Cement and fly ash together in the same mix make up the total Cementious material.

- **Fly ash improves workability**
- **Fly ash is easier to finish**
- **Fly ash reduces the heat generated by the concrete**
- **Fly ash costs ¼ to ½ the amount of the cement it replaces**

Admixtures Cont…

Air Entraining Admixtures

must be used whenever concrete is exposed to freezing and thawing. Air entraining agents entrains microscopic air bubbles in the concrete: when the hardened concrete freezes, the frozen water inside the concrete expands into these air bubbles instead of damaging the concrete. For example Vinsol resin and Dadex

Admixtures Cont…

- **Air entrainment improves concrete workability**
- **Air entrainment improves durability**
- **Air entrainment produces a more workable mix**

Water reducing admixtures-reduces the amount of water needed in the concrete mix. The water cement ratio will be lower and the strength will be greater. Most low range water reducers reduce the water needed in the mix by 5%-10%. High range water reducers reduce the mix water needed by 12% to 30% but are very expensive and rarely used in residential work.

Admixtures Cont…

Assignment#2

- **Chemical Admixtures; Plasticizers; Plasticizing action**
- **Factors affecting plasticizers; Super plasticizers**

<u>Presentations on Admixtures#2</u>

Mineral Admixtures; Silica Fume, Fly ash ; Blast Furnace Slag, Rice husk ash; Volcanic ash

Properties of Concrete

Desired Properties of Concrete

1. **The concrete mix is workable. It can be placed and consolidated properly by yourself or your workmen.**

2. **Desired qualities of the hardened concrete are met: for example, resistance to freezing and thawing and water tightness (low permeability), wear resistance, and strength.**

Properties of Concrete Cont..

3. Economy. Since the quality depends mainly on the water to cement ratio, the water requirement should be minimized to reduce the cement requirement (and thus reduce the cost).

Take these steps to reduce the water and cement requirements:

- **use the stiffest mix possible**
- **use the largest size aggregate practical for the job**
- **Use the optimum ratio of fine to coarse aggregate**

Properties of Concrete Cont..

WORKABILITY OF CONCRETE

"The ease with which a concrete can be compacted 100% having regard to the mode of compaction and place of deposition"

Every job requires particular workability.

Right workability ▸ durability ▸ Economy

Workability ▸ parameter ▸ a mix designer must satisfy ▸ in mix design ▸ with proper understanding of

Type of work

Distance of transport

Loss of slump

Method of placing

Properties of Concrete Cont..

Factors affecting workability

- ***Water content***
- ***Mix proportion***
- ***Size of aggregates***
- ***Shape of aggregates***
- ***Surface Texture of aggregates***
- ***Grading of aggregates***
- ***Use of admixture***

Water content:

Higher water content ▸ higher fluidity ▸ greater workability

Increase in water ▸ bleeding ▸ escape of water through joints of formwork

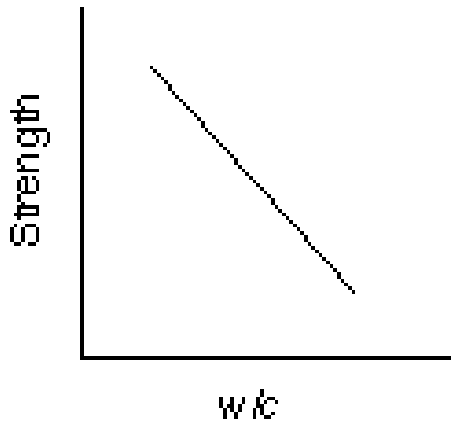
Properties of Concrete Cont..

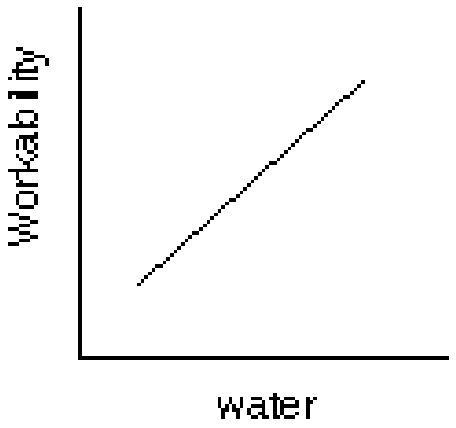
Mix proportion:

The ingredients of concrete can be proportioned by weight or volume. The goal is to provide the desired strength and workability at minimum expense.

As mentioned previously, a low water-to-cement ratio is needed to achieve strong concrete. It would seem therefore that by merely keeping the cement content high one could use enough water for good workability and still have a low w/c ratio. The problem is that cement is the most costly of the basic ingredients. The dilemma is easily seen in the schematic graphs of Figure 3.

Properties of Concrete Cont..





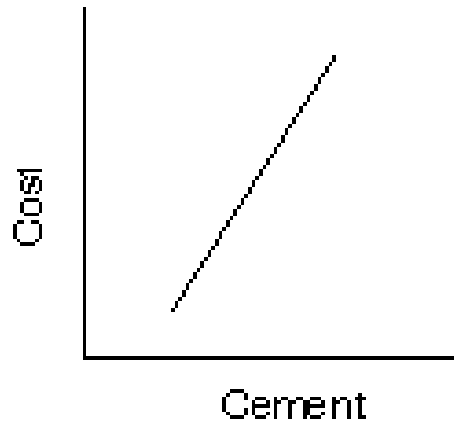


Figure 3. Mix Proportion relationships.

Properties of Concrete Cont..

Size of aggregates

Since larger aggregate sizes have relatively smaller surface areas (for the cement paste to coat) and since less water means less cement, it is often said that one should use the largest practical aggregate size and the stiffest practical mix. (Most building elements are constructed with a maximum aggregate size of 3/4 to 1 in, larger sizes being prohibited by the closeness of the reinforcing bars.)

Properties of Concrete Cont..

Shape of aggregates

Angular aggregates; increased flakiness or elongation, reduces workability

Round smooth aggregates; require less water for lubrication And gives Greater workability with a given w/c ratio.

Surface texture of aggregates

Porous aggregates; need more water as compared to non absorbent aggregates for achieving same degree of workability.

Properties of Concrete Cont..

Secondary important factor

Grading of aggregates:
Important factor ▸

- **maximum influence on workability**
- **Well graded aggregates**
- **least amount of voids in a given volume**
- **Less voids**
- **Mix is cohesive**
- **prevent segregation**

Properties of Concrete Cont..

Use of admixture

Use of air entraining agent; increase mobility workability, decrease bleeding/ segregation

Fine pozzolanic materials give better lubricating effect and increase workability.

A good concrete is one which has workability in the fresh state and develops adequate strength. Maximum strength of concrete can only be obtained, if the concrete has adequate degree of workability in relation to the method of compaction to be used. Concrete which is to be compacted by mechanical vibrator will need 15% less water and 15% less cement as compared to the one which has to be compacted by hand.

Properties of Concrete Cont..

Pouring a concrete floor for a commercial building

Properties of Concrete Cont..

Installing rebar in a concrete floor during a pour

Properties of Concrete Cont..

Good concrete can be obtained by using a wide variety of mix proportions if proper mix design procedures are used. A good general rule to use is the rule of 6's:

A minimum cement content of 6 bags per cubic yard of concrete,

A maximum water content of 6 gallons per bag of cement,

A curing period (keeping concrete moist) a minimum of 6 days, and

An air content of 6 percent (if concrete will be subject to freezing and thawing).

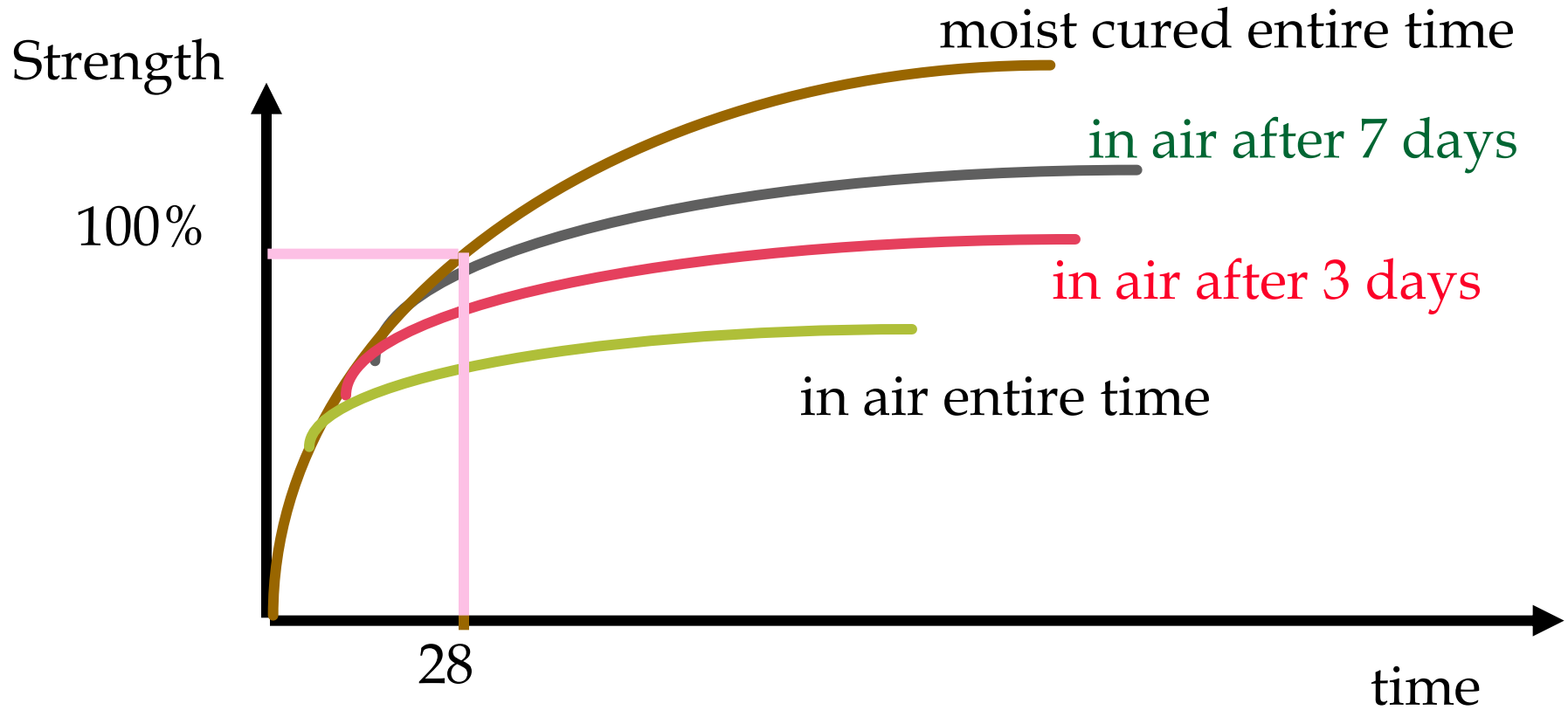
Hardened Concrete Properties

- **Strength**
  - **Compressive strength 2000-8000 psi**
  - **Tensile strength 200-800 psi**
  - **Compression >> tension since concrete is notch (scratch) sensitive**

Factors Affecting Strength

- **Curing conditions, humidity**
- **Temperature**
- **w/c , (inversely related) Abram's law**
- **Air content, (inversely related), short and long term**
- **Aggregate characteristics, roughness,grading, mineralogy.**
- **Cement type, composition, fineness, type I vs. type III**
- **Cement content (directly related)**

Strength and Curing



Durability

- Resistance to freezing and thawing
- Cracking
- Internal Problems
- Rebar Corrosion


THANK YOU
3 17:42