Introduction to Infrastructural Engineering

Construction Materials1

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Composition of concrete

a) Water
b) Aggregates
c) Reinforcement
d) Chemical admixtures
e) Cement

Concrete production

a) Mixing Concrete
b) Workability
c) Curing

Composition of concrete

- Water
- Aggregates
- Chemical admixtures
- Cement

http://www.bu.edu/sjmag/scimag2008/images/Texture__Concrete_Cracked_by_ivelt_resources.jpg

Water

- Good water is essential for quality concrete.
- Should be good enough to drink--free of trash, organic matter and excessive chemicals and/or minerals.
- The strength and other properties of concrete are highly dependent on the amount of water and the water-cement ratio.

Chemical admixtures

- Materials in the form of powder or fluids that are added to the concrete to give it certain characteristics not obtainable with plain concrete mixes.

- In normal use, admixture dosages are less than 5% by mass of cement, and are added to the concrete at the time of batching/mixing.

Aggregates

- Aggregates occupy 60 to 80 percent of the volume of concrete.
- Sand, gravel and crushed stone are the primary aggregates used.
- All aggregates must be essentially free of silt and/or organic matter.

Chemical admixtures

The most common types of admixtures are:

- **Accelerators** :

  - Speed up the hydration (hardening) of the concrete. - Typical materials used are $CaCl_2$ and NaCl.

- **Acrylic retarders** :

  -Slow the hydration of concrete, and are used in large or difficult pours.

  - Typical retarder is table sugar, or sucrose ($C_{12}H_{22}O_{11}$).

Chemical admixtures

- **Air Entraining agents**:

  -The most commonly used admixtures for agricultural concrete.

  -Produce microscopic air bubbles throughout the concrete.

  -Entrained air bubbles:

  - Improve the durability of concrete exposed to moisture and freeze/thaw action.
  - Improve resistance to scaling from deicers and corrosive agents such as manure or silage.

Chemical admixtures

- **Water-reducing admixtures**

-Increase the workability of plastic or "fresh" concrete, allowing it be placed more easily, with less consolidating effort.

-High-range water-reducing admixtures are a class of water-reducing admixtures

  - Increase workability
  - Reduce the water content of a concrete.
  - Improves its strength and durability characteristics.