السويس للأسمنت
Suez Cement

Suez Cement Company
K30 Maadi/Ein Sokhna Road
Cairo, P.o. Box 2691
Egypt

Tel. 002 02 25 22 20 00
Fax 002 02 25 22 20 67
www.suezcem.com.eg

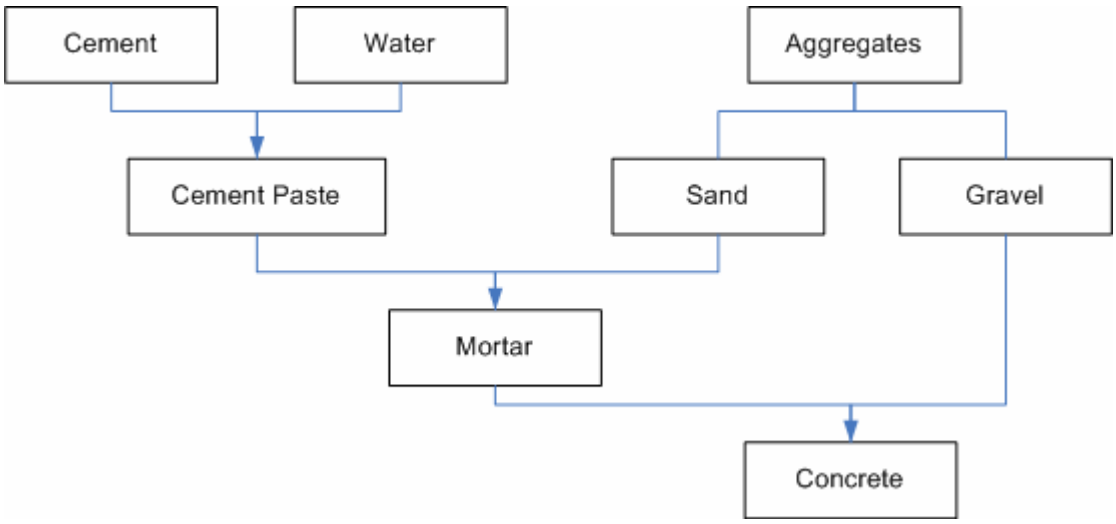
1. Definition

Concrete is basically a mixture of two components:

- Paste
- Aggregates

The paste, usually comprised of Portland cement and water, binds the aggregates (sand and gravel or crushed stone) into a rocklike mass as the Paste hardness because of the chemical reaction of the cement and water.

2. Constituents



3. How to check a freshly mixed concrete?

- Freshly mixed concrete shall be plastic or semi-fluid and generally capable of being molded by hand.
- A very wet concrete mixture can be molded in the sense that it can be cast in mould.
- In good concrete all grains of sand and pieces of gravel or stone are encased and held in suspension.
- The ingredients are not able to segregate during transport.
- When the concrete hardens, it becomes a homogenous mixture of all the components.

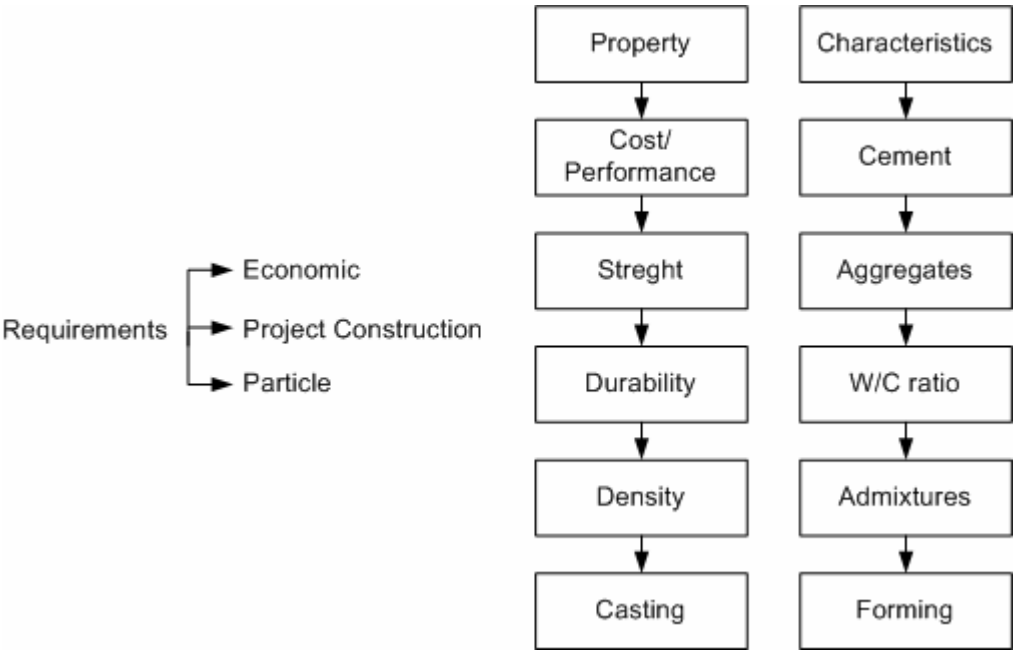
- Concrete of plastic consistency does not crumble but flows sluggishly without segregation.

4. How to make a good concrete?

A good concrete could be done through:

- Convenient Mix Design
- Laboratory tests for Specifications & Performances

Convenient Mix Design



Laboratory Tests

Requirements to meet concrete specifications

- ***Types of Cement →***
  - Strengths Development
  - Mechanical Performance
  - Sulphate Resistance
  - Heat of Hydration

- ***Aggregates →***
  - Maximum Diameter
  - Crushed / Natural
  - Content in fines
  - Durability

Requirements to improve concrete performance

- ***Admixtures →***
  - Durability
  - Workability
  - Set retarders of accelerators
- ***Additives →***
  - Workability
  - Durability (e.g. alkali/ aggregate reaction).

Approx. Example:

Composition of medium characteristics concrete (% of mass)

Aggregates	=	1900 kg/m^3	→	About 30% of mass
Cement	=	350 kg/m^3	→	About 12% of mass
Water	=	200 kg/m^3	→	About 8% of mass

5. Composition of Concrete

- Cement
  Portland cements are hydraulic cements that is, they set & harden by reacting with water to form a paste. The paste is usually composed of Portland Cement, water, and entrapped air or purposely entrained air. The paste ordinarily constitutes about 25% to 40% of the total volume of concrete. The absolute volume of cementing materials is usually between 7% and 15% and the water between 14% and 21%. Air content in air-entrained concrete ranges up to about 8% of the volume of concrete, depending on the top size of the coarse aggregates.

- Aggregates
  Aggregates are generally divided into two groups: fine and coarse. Fine aggregates consist of natural or manufactured sand with particle size

ranging up to 10mm. Coarse aggregates are those with particles retained on the 1.25mm sieve and ranging up to 150mm. The most commonly used maximum aggregate size is 20mm.
Since aggregates make up about 60% to 75% of the total volume of concrete, their selection is important.
Aggregates should consist of particles with adequate strength and resistance to exposure conditions and should not contain materials that will cause deterioration of the concrete. A continuous gradation of particle sizes is desirable for efficient use of the paste.

- Water
  Water should be clear and free of salts (sulphates and chlorine). For any particular set of materials and conditions of curing, the strength of hardened concrete is determined by the amount of water used in relation to the amount of cement, but in the concrete the advantages of adjusting the W/C ratio are:
    - Increased compressive and flexural strength.
    - Lower permeability, thus increased water tightness and lower absorption.
    - Increased resistance to weathering.
    - Better bond between successive layers and between concrete and reinforcement.
    - Less volume change from wetting & drying.
    - Reduced shrinkage cracking tendencies.

  The less water used, the better the quality of the concrete, provided it can be consolidated properly.
  Smaller amounts of mixing water result in stiffer mixtures, but with vibration, the stiffer mixtures can be used. For a given quality of concrete, stiffer mixtures are more economical. Thus consolidation by vibration permits improvement in the quality of concrete and in economy. In general all available potable water can be used in concrete mixtures.

6. Directions for Better Application

To get best results it is recommended to follow these instructions:

- Aggregates used for concrete mix (sand and gravel) should be precisely cleaned before the mixing process.
- Sand and gravel should be assured free of clay and organic impurities.
- It is preferable to perform a good dry mix process for cement and aggregates to insure the dry constituents homogeneity before adding the mixing water.

- Water used for mixing should be valid. Generally potable water can be used for the cementing mixtures.
- It is preferable to use cement before its half-age of validity. In general it is recommended to retest cement after half-age validity.
- Storing instructions should be properly followed.