Unit 2

Admixtures & fresh concrete

Module 1

Introduction

- Admixture is defined as a material, other than cement, water and aggregates that is used as an ingredient of concrete and is added to the batch immediately before or during mixing.
- Additive can also be a material which is added at the time of grinding cement clinker at the cement factory.
- These days concrete is being used for wide varieties of purposes to make it suitable in different conditions. In these conditions ordinary concrete may fail to exhibit the required quality performance or durability.
- In such cases, admixture is used to modify the properties of ordinary concrete so as to make it more suitable for any situation.

- The following admixtures are studied in this topic:
- i) Plasticizers
- ii) Superplasticizers
- iii) Retarders and Retarding Plasticizers
- iv) Accelerators and Accelerating Plasticizers
- v) Air-entraining Admixtures
- vi) Pozzolanic or Mineral Admixtures
- vii) Damp-proofing and Waterproofing Admixtures
- viii) Gas forming Admixtures

- ix) Air-detraining Admixtures
- x) Alkali-aggregate Expansion Inhibiting Admixtures
- xi) Workability Admixtures
- xii) Grouting Admixtures
- xiii) Corrosion Inhibiting Admixtures
- xiv) Bonding Admixtures
- xv) Fungicidal, Germicidal, Insecticidal Admixtures
- xvi) Colouring Admixtures

Plasticizers (Water Reducers):

- The use of super-plasticizer has become almost an universal practice to reduce water/cement ratio for the given workability, which naturally increases the strength.
- Moreover, the reduction in water/cement ratio improves the durability of concrete.
- Calcium, sodium and ammonium lignosulphonates are the mostly used plasticizers. Plasticizers are used in the amount of 0.1% to
- 0.4% by weight of cement.
- At these doses, at constant workability the reduction in mixing water is expected to be of the order of 5% to 15%. This naturally increases the strength.
- The increase in workability that can be expected, at the same w/c ratio, may be anything from 30 mm to 150 mm slump.

Retarders:

- A retarder is an admixture that slows down the chemical process of hydration so that concrete remains plastic and workable for a longer time than concrete without the retarder.
- Calcium sulphate (gypsum) is the most commonly used retarder. In addition to gypsum there are number of other materials found to be suitable for this purpose.
- They are: starches, cellulose products, sugars, acids or salts of acids. Other admixtures which have been successfully used as retarding agents are Lignosulphonic acids and their salts, hydroxylated carboxylic acids and their salts which in addition to the retarding effect also reduce the quantity of water requirement for a given workability.

Accelerators:

- Accelerators are added to concrete to increase the rate of early strength development in concrete to
- i) permit earlier removal of formwork;
- ii) reduce the required period of curing;
- iii) advance the time that a structure can be placed in service;
- iv) in the emergency repair work.
- Calcium chloride, some of the soluble carbonates, silicates fluosilicates and some of the organic compounds such as triethenolamine are commonly used accelerators.

Air-entraining Admixture:

- Air entrained concrete is made by mixing a small quantity of air entraining agent or by using air entraining cement.
- These air entraining agents incorporate millions of non-coalescing air bubbles, which will act as flexible ball bearings and will modify the properties of plastic concrete regarding workability, segregation, bleeding and finishing quality of concrete.
- It also modifies the properties of hardened concrete regarding its resistance to frost action and permeability.
- The following types of air entraining agents are used for making air entrained concrete.

Pozzolanic or Mineral Admixtures:

- **Pozzolanic or Mineral Admixtures:**
- Best pozzolans in optimum proportions mixed with Portland cement improves many qualities of
- concrete, such as:
- (a) Lower the heat of hydration and thermal shrinkage;
- (b) Increase the watertightness;
- (c) Reduce the alkali-aggregate reaction;
- (d) Improve resistance to attack by sulphate soils and sea water;
- (e) Improve extensibility;
- (f) Lower susceptibility to dissolution and leaching;
- (g) Improve workability;
- (h) Lower costs.

- Pozzolanic materials are siliceous or siliceous and aluminous materials, which in themselves possess little or no cementitious value, but will, in finely divided form and in the presence of moisture, chemically react with calcium hydroxide liberated on hydration, at ordinary temperature, to form compounds, possessing cementitious properties.
- Examples of Natural Pozzolans are Clay and Shales, Opalinc Cherts, Diatomaceous Earth, Volcanic Tuffs and Pumicites.
- Examples of artificial pozzolans are Fly ash, Blast Furnace Slag, Silica Fume, Rice Husk ash,
- Metakaoline, Surkhi.