

## **Additives and Admixtures (Part-1)**

### **ADDITIVES**

Additives are chemical components that will be added to the cement during its manufacturing to get new properties for cement. The raw materials used in the manufacturing of cement are lime, silica, alumina and iron oxide. These materials are grounded into a fine powder and are mixed followed by roasting. Heating of this mixture to about 1500°C will initiate a number of chemical reactions that give the final chemical composition of cement. In order to obtain desired properties, various additives are added to cement while manufacturing. These chemical components are:

#### **Accelerators**

Accelerators are added to reduce cement setting time and to speed up the development of compressive strength.

#### **Retarders**

Retarders extend the cement setting time. This helps the cement to have sufficient time for slurry placement in deep wells.

#### **Dispersants**

Dispersants are added to reduce the viscosity of cement slurry and to ensure good mud removal during placement.

#### **Fluid Loss Control Agents**

Fluid loss control agents control water loss from the cement into the formation. Some accelerators added to cement are calcium chloride ( $\text{CaCl}_2$ ), sodium chloride ( $\text{NaCl}$ ), sea water and potassium chloride ( $\text{KCl}$ ).

### **ADMIXTURES**

Admixtures are chemicals that are added to concrete mixtures while mixing in order to get the new properties. Admixtures are the components in concrete other than cement, water and aggregates. Admixtures are added to cement immediately before or during mixing the concrete mixture. Admixtures are added for the following functions:

1. Intentionally entrain air
2. Reduce water requirement
3. Increase workability
4. Adjust the settling time
5. Adjust the strength

Finally we can say that the admixtures are chemicals added to freshly batched concrete to improve the concrete properties for particular construction or landscaping applications. Some admixtures make the concrete set faster or slower, or make it denser, or make it stronger and more durable. Admixtures are natural or manufactured chemicals which are added to the concrete before or during mixing. An admixture is a substance which can be added to concrete to achieve or modify its properties. Admixtures are used to modify properties of both fresh and hardened concrete like to increase its workability without increasing and decreasing the water content. Admixtures are classed according to function. There are five distinct classes of chemical admixtures:

1. air-entraining,
2. water-reducing,
3. water-retarding,
4. water- accelerating,
5. and plasticizers (superplasticizers).

### **Difference between Additives and Admixtures**

#### **Additives:**

Additives are chemical components added to cement during manufacturing to get new properties for cement. The additives are classified as accelerators, retarders, dispersants, fluid loss control agents, etc.

**Admixtures:** Admixtures are chemical components that are added to concrete mixtures while mixing to get new properties. The admixtures are classified as air retaining admixtures, plasticizers, water-reducing admixtures, etc.

**Additives are added to cement while manufacturing. Admixtures are added to the concrete mixture before or during mixing. The main difference between additives and admixtures is that additives are added to cement during manufacturing to get new**

**properties for cement whereas admixtures are added to concrete mixtures while mixing to get new properties.**

## **WATER REPELLENTS AND WATER PROOFING AGENTS**

Water repellent are natural or synthetic materials that are laminated or coated with a waterproofing material such as rubber, polyvinyl chloride (PVC), polyurethane (PU), silicone elastomer, fluoropolymers, and wax. Water-resistant/repellent material is able to resist the penetration of water to some degree but not entirely. Water-repellent material does not allow the easy penetration of water. Water proofing materials are those materials that are impervious to water.

**Water repellency** is a term used to describe the characteristic of both water-resistant and waterproof products once a durable water repellent ( DWR) is applied. If a product is labelled as “water-repellent”, it means that it is hydrophobic, or repels water on contact.

If a product is labeled as “water-repellent”, it means that it is hydrophobic, or repels water on contact. A feature of water-resistant and waterproof fabrics, water repellency measures how much water pressure a material can withstand before water begins to permeate.

### **Benefits of Waterproofing**

Each building is subject to deterioration if it is not properly maintained. In this way, some natural factors such as air, water, climate, wind and humidity becomes manageable. If a structure is not protected from water, problems such as deterioration or damage to a structure from foundation to plaster can be encountered. Against the following causes buildings need to be protected against water:

- Natural factors
- Unexpected fire accidents
- Water - rain and humidity
- Strong wind
- Big earthquakes
- Non-natural factors
- Damage caused by theft
- Collapse of buildings
- Structural failure in buildings
- Other anti-social actions

Building waterproofing is a process to prevent water from entering a building. In general, extensive waterproofing measures are done during construction. The waterproofing can also be done after a building has been constructed, or when it requires any improvement or renovation. But, it is always better to go for water proofing during the construction phase. Special attention should be given for waterproofing of roof, toilets and other wet areas.

### **Methods of Waterproofing**

In order to prevent water leakage and accumulation of water, waterproofing is carried out in layers on the top of the structure, while retaining its respiratory characteristics. Internally, it removes the existing water content in the structure and externally forms a protective structure around itself. Typically, the building waterproofing system is constructed by creating a large number of barriers so that water cannot enter into the building.

The development of these multiple layers forms a structure around the building with the materials and techniques inside. This structure can be considered as a sustainable property or a green building measure by preventing excessive heat from escaping outside. This can be done by applying a variety of paints, coatings and other materials of coatings.

### **Waterproofing Applications on Roofs**

One of the main areas where waterproofing is applied in constructions is the main frame of the building. This main frame covers the construction and roof of the building. It protects the building from rain, snow, and frost. Roofing materials are generally designed to drain water from a water-resistant. In some cases they are also equipped to defend the building against frosting as well. For this reason, both the general geographical location of the house and the facade of the house in this general position are important aspects to be considered. For example, if the house is in a place of constant rainfall, its roof should be designed accordingly. The answer to the question of what are the best waterproofing materials for roofs is directly related to these properties.

### **Waterproofing on Walls**

When you are looking for an answer to the question of what are waterproofing materials, you should act according to the characteristics of the region where you will apply waterproofing. The waterproofing materials used for the roof and the waterproofing materials insulated for the wall will not be identical. This is because these surfaces are different from the water they

are exposed to. Walls must also have vapour barriers or air barriers. Sometimes waterproofing in some houses on the walls with the right materials, moisture problems may be experienced. This may be due to the fact that a suitable material is not selected for moisture insulation. In such cases, the answer to the question of what are waterproofing materials becomes even more important. Moisture insulation is another aspect of waterproofing. The masonry walls are constructed with a moisture resistant road to prevent moisture from rising, and the concrete in the foundations is rendered damp or waterproof by a liquid coating, basement waterproofing membrane.

### **Different Waterproofing Methods**

The different types of water proofing methods available are:

#### **1. Cement Based Waterproofing Method**

Cement based waterproofing is the easiest waterproofing method in construction. Cement based waterproofing materials are easily available from various suppliers and they are easy to mix and apply. This method is often used in domestic wet areas such as bathrooms and toilets. This method is usually a complete or semi-flexible type of waterproofing. It is used in areas that are not sunlight or weather conditions. Cement based waterproofing is used in the following structures:

1. Water treatment plants
2. Sewage Treatment Plants
3. Bridges
4. Dams
5. Railway and metro systems
6. Sea cargo port and docks
7. River locks / canals and concrete dykes
8. Parking structures
9. Tunnels
10. Cement based waterproofing is used in these areas

#### **2. Liquid Waterproofing Membrane Method**

The liquid waterproofing membrane method is a thin coating, usually consisting of a primer coat and two coats of top coat applied by spray, roller or trowel. It offers more flexibility than cement based waterproofing types. Therefore, it is used more intensely nowadays. So, how to apply the liquid waterproofing membrane method? The durability of the waterproofing

coating depends on what kind of polymer the manufacturer uses in the construction of liquid waterproofing. The liquid waterproofing membrane may be a spray-applied liquid membrane composed of polymer modified asphalt. Different degrees of acrylic, hybrid or polyurethane liquid membranes for trowel, roller or spray are also available from various manufacturers.

### **3. Bituminous Coating Waterproofing Method**

Bituminous coating is a type of coating used for waterproofing and flexible protective coating in accordance with the degree of formulation and polymerization. Its flexibility and protection against water can be influenced by the polymer class as well as the reinforcement of the fiber. Bituminous coating is also called asphalt coating. The most common applications of bituminous coatings include areas under the screed. It is an excellent protective coating and waterproofing material on surfaces such as concrete foundations.

The bituminous coating is made of bitumen based materials and is not suitable for exposure to sunlight. As long as it is not modified by a more flexible material such as polyurethane or acrylic based polymers, it becomes very fragile when exposed to sunlight for a long time. The flexibility of finished products always depends on the solids content of the polymer added to the bit.

### **4. Bitumen Membrane Waterproofing Method**

Bituminous membrane waterproofing is a popular method used on low slope roofs due to their proven performance. It is a bituminous waterproofing membrane and self-adhesive membrane. In addition to the self-adhesive compounds, asphalt, polymer and filler, certain resins and oils may be added to improve the adhesion properties. As the adhesion properties of the membrane decrease over time, the self-adhesive type has a low shelf life.

### **5. Polyurethane Liquid Membrane Waterproofing Method**

Polyurethane liquid membrane waterproofing method is used for flat roof area and is exposed to weather conditions. This waterproofing method is expensive compared to others. Polyurethane Liquid Membrane can offer higher flexibility. Polyurethane is very sensitive to the present moisture content, so it is necessary to be very careful when evaluating the moisture content of the concrete slab before application, otherwise the membranes may peel off or bond after a period of time.

## **ACCELERATORS**

Accelerating admixtures are added to concrete to increase the rate of early strength development. Accelerators are so powerful that it is possible to make the cement set into stone hard in a matter of five minutes or less. Accelerating Admixture are admixtures that causes an increase in the rate of hydration of the hydraulic cement and thus shortens the time of setting, increases the rate of strength development, or both. Accelerating admixtures are added to concrete either to increase the rate of early strength development or to shorten the time of setting, or both. The accelerators are used for the following benefits:

1. With the availability of such powerful accelerator, the underwater concreting has become easy.
2. Similarly, the repair work that would be carried out to the waterfront structures in the region of tidal variations has become easy.
3. The use of such powerful accelerators have facilitated, the basement waterproofing operations.
4. Permit earlier removal of formwork
5. Reduce the required period of curing
6. Advance the time that a structure can be placed in service
7. Partially compensate for the retarding effect of low temperature during cold weather concreting.
8. In the emergency repair work.

**The Commonly used materials as an accelerator are :**

1. Calcium chloride (Not used now)
2. Some of the soluble carbonates
3. Silicates fluosilicates (Expensive)
4. Some of the organic compounds such as triethanolamine (Expensive)