

## Topic 12 SPECIAL TYPES OF CONCRETE

### Sulphate Resisting Concrete

Sulphate Resisting Cement is a type of Portland Cement in which the amount of Tricalcium Aluminate ( $C_3A$ ) is restricted to lower than 5% and ( $2 C_3A + C_4AF$ ) lower than 25%, which reduces the formation of sulphate salts. The reduction of sulphate salts lowers the possibility of sulphate attack on the concrete. It is known that sulfate attack on concrete can lead to excessive expansion, cracking, delamination, loss of strength and loss of mass. This can be associated with the chemical reactions between hardened cement pastes and sulfate ions leading to formation of new compounds and alteration of existing phases.

### Characteristics of Sulphate Resisting Cement

- This cement provides maximum resistance to chloride ions – minimising the risk of corrosion of reinforced steel.
- It also provides high level of concrete performance and structural integrity in highly aggressive sulphate and acidic environments.
- It also has increased workability and pumpability.
- This cement has significantly improved later-age concrete strengths.

### Uses of Sulphate Resisting Cement

- Foundations.
- Piling works.
- Construction in contact with soils or ground water having more than 0.2% or 0.3 % g/l sulphate salts respectively.
- Concrete surfaces subjected to alternate wetting and drying such as bridge piers, concrete surface in tidal zone, apron etc.
- Effluent treatment plants.
- Chimney, cooling towers.
- Coastal protective works such as sea walls, break waters, tetrapods etc.
- Building near seacoast.
- Chemical industries, water storage, sumps, drainage works.
- Suitable for underground works where Sulphate is present in the Soil and water.

## Advantages & Disadvantages of Sulphate Resisting Cement

- The use of sulphate resisting cement provides excellent protection against the formation of sulpho-aluminates and consequent resistance to concrete against sulphate attack.
- Very high compressive strength by economic concrete mix design.
- Very low heat of hydration helps to avoid shrinkage cracks.
- Improves life and durability of structures under aggressive conditions.
- Improves corrosion resistance of steel by preventing sulphate attack.
- Sulphate resisting cement is not suitable where there is danger of chloride attack. This will cause corrosion of rebar.
- Curing process should be done properly with great care for minimum of 8- 10 days.
- It is not prescribed to use it in marine construction.

Underwater Concreting Specially designed process to enhance constructability and performance in water. It can be characterized by the concrete resistance to washout, segregation and bleeding and is affected by the mix proportioning, aggregate shape and gradation, admixtures, vibration and placement conditions.

Three important characteristics Flowability, Self-consolidation and Cohesion. The behaviour of fresh concrete depends on two parameters – yield stress and plastic viscosity.

Concrete placed underwater is susceptible to

- Cement washout
- Laitance
- Segregation

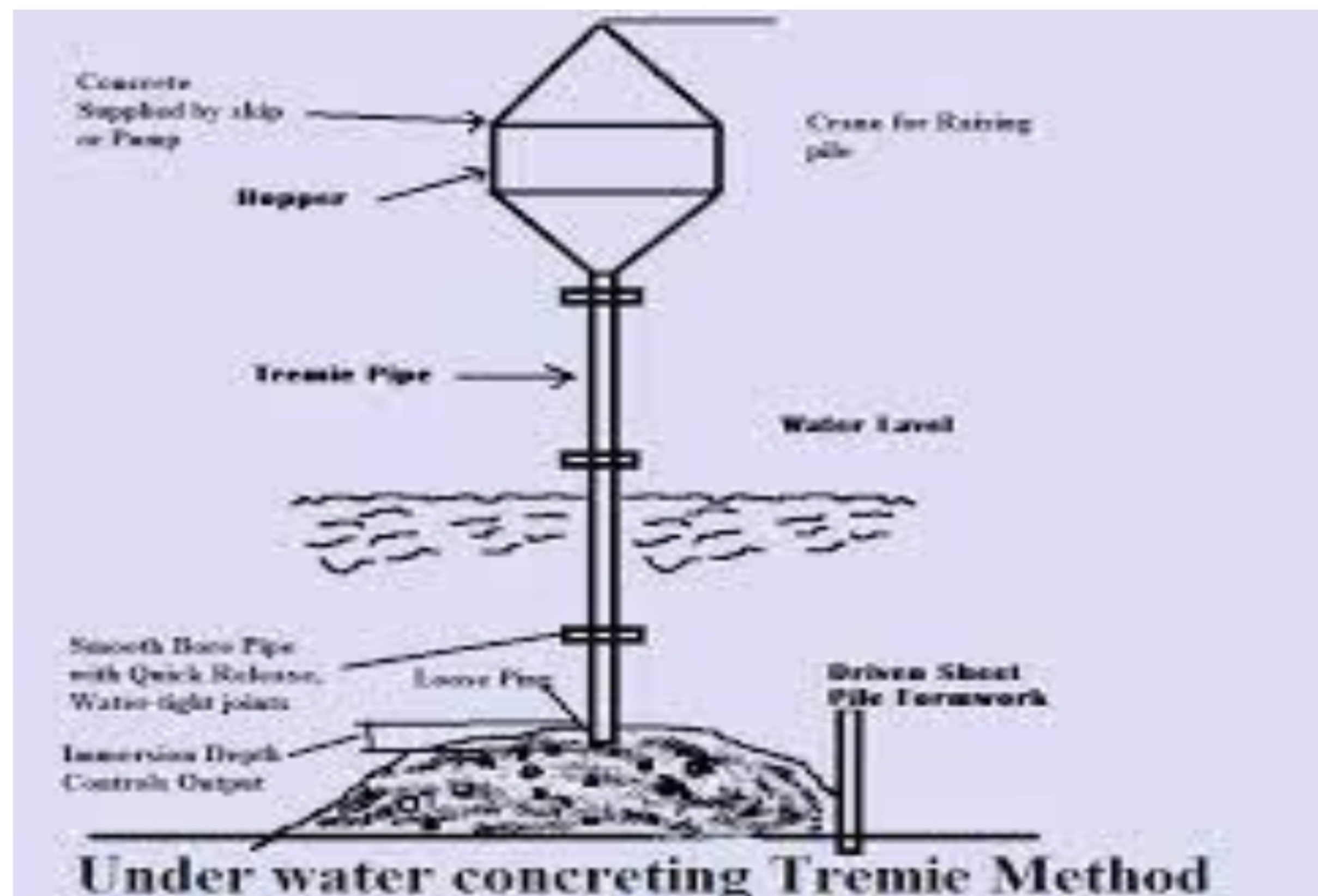
Underwater Concreting The underwater concreting techniques designed mostly to prevent cement washout. Methods to carry out underwater concreting:

- Tremie method
- Pumping methods
- Hydro valve method
- Pneumatic valve method
- Skip method
- Tilting pallet barge method
- Preplaced aggregate concrete
- Toggle bags method

- Bagged concrete method

### Tremie Method 8

- A Tremie is a watertight pipe.
- Generally 250 mm in Dia.
- Funnel shaped at its upper end and loose plug at the bottom.
- It is supported on a working platform above water level.



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### Pumpable Concrete

Concrete which can be pushed under pressure through a pipeline system. Admixtures such as air entraining agents, fly ash or water reducing agents are used for producing these types of concrete.

Most important factor that affect pumpability is slump. Effect of properties of aggregate on pumpability: Size of aggregate (hose size as well), Shape and surface texture, gradation of particle size, porosity.