

Concrete and RCC

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Most of the multistoried buildings in Mumbai are constructed using concrete and RCC. Let us discuss some basics about these materials today.

What is concrete?

Concrete is a widely used material for construction of various civil engineering structures. It is a composite material mainly used for structural applications. Sometimes concrete is also used for non-structural applications. One of the main advantages of concrete is that it can be molded into required shapes. Concrete is relatively less expensive than other structural materials such as steel.

How is it made?

Concrete is obtained by mixing cement, fine aggregate (sand) and coarse aggregate (stone pieces) in required proportions. Water is added in the required measure and the mixture is mixed in a mechanical mixer to achieve concrete. Concrete is poured into the formwork (mould made up of plywood, timber or steel plates) to get the desired shape. It is then vibrated to achieve proper compaction (uniform denseness). In this process, high temperature is generated through a chemical reaction. Curing with water is essential to control this temperature. Once concrete has gained sufficient strength, its formwork is removed.

Strength

Concrete gains strength progressively with time. The strength achieved at the end of 28 days is called the Characteristic Compressive Strength of concrete and is designated as the "Grade" of concrete. About 67% of this strength is achieved at the end of 7 days from the date of casting. Concrete continues to gain strength even beyond 28 days, albeit marginally. At the time of casting of concrete, sample cubes are also cast. These cubes are tested in a laboratory to verify the strength of concrete.

Durability

Durability is the ability of concrete to perform well over a long period of time without much deterioration. Useful structural life of a building depends on the durability of the concrete used in it. Denser the concrete, more durable it is.

Quality

The strength and durability together represent the "quality" of concrete. Being a material molded at site, the quality of concrete not only depends on the quality of its ingredients but also on the process of mixing, placement, vibration and curing which together contribute to its 'workmanship'. To a large extent, the quality of concrete depends also on the amount of water added to it. Too much or too little water can adversely affect its quality. Nowadays additives such as special chemicals and fibers are used to enhance its quality.

Grades

Depending on the requirements, different grades of concrete can be obtained by mixing its ingredients in different proportions. These grades are designated as the letter "M" followed by a number, which represents its strength. For example, grade M25 represents concrete, which has a compressive strength of 25 N/Sq.mm. Grades M15 and M20 were common in Mumbai until year 2000. Present standards and the requirements of earthquake resistant structures indicate that for Mumbai, the grade should be preferably M25 or higher.

What is RCC?

RCC stands for Reinforced Cement Concrete. RCC helps in transferring the loads of a building safely to the soil below through the structural members of its frame. Since concrete is weak in tension, to enhance its load carrying capacity it is reinforced with steel reinforcement bars called "Rebars". Such concrete is called Reinforced Concrete. These rebars are provided in the required number and diameters and in an appropriate manner as per the requirements of structural design. The rebars are embedded in concrete at a certain depth from its surface. This layer, which provides protection to the rebars, is called the "cover concrete".

Deterioration of RCC

The main cause of deterioration of RCC is corrosion of rebars. The corrosion of rebars is caused by the following factors:

- Porous concrete which allows seepage
- Saline environment
- Attack by adverse chemicals
- Pollution
- Inadequate cover
- Inadequate grade of concrete

When a rebar corrodes, the volume of the corroded part increases several times. This increase in volume exerts strong pressure on the concrete from inside, which leads to its cracking, spalling (separation) and disintegration. This causes further exposure, additional ingress of water and additional corrosion leading to further deterioration and so on. Sometimes the bars may become very thin and may eventually break. Overloading, misuse and neglect can accelerate this unhealthy process. Good maintenance and proper and timely action are, therefore, necessary for good performance of RCC structures.

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