

3.3 FIBRE REINFORCED CONCRETE

FRC can be defined as a composite material, consisting of mixtures of cement mortar or concrete and discontinuous, discrete uniformly dispersed suitable fibres.

Fibre is a small piece of reinforcing material that can be circular or flat.

Fibre reinforced concrete is defined as concrete made with hydraulic cement, containing fine or fine and coarse aggregate and discontinuous discrete fibres. The fibres can be made from natural material like cellulose, sisal or from artificial material like glass, polymers, carbon and steel. The quantity of fibres used is about 1 % to 5 % by volume. The reason of reinforcing the cement-based matrix with fibres is to increase the tensile strength by delaying the growth of cracks. Steel fibre is one of the most commonly used fibre. The diameter may vary from 0.25 mm to 0.75 mm. Nylon fibres are found suitable to increase the impact strength of concrete. They possess very high tensile strength. Fibres may be circular or flat. Glass fibre is a recent introduction in making fibre concrete.

Properties of FRC:

It has more tensile strength.

Fibres improve the impact and abrasion resistance of concrete. It possesses high compressive strength.

It possesses low thermal and electrical conductivity.

Aspect ratio

The fibre is often described by a convenient parameter called “aspect ratio”. The aspect ratio of the fibre is the ratio of its length to its diameter. Typical aspect ratio ranges from 30 to 150.

Types of Fibres:

1. Steel Fibres
2. Glass Fibres
3. Polypropylene Fibres
4. Slurry Infiltrated Fibre Concrete (SIFCON)
5. Asbestos

6. Carbon

1. Steel Fibres

Steel fibre is one of the most commonly used fibre. Generally round fibres are used. The diameter may vary from 0.25 to 0.75mm. The steel fibre is likely to get rusted and lose some of its strength. But investigations have shown that the rusting of the fibres take place only at the surface. Use of steel fibre makes significant improvements in flexural, impact and fatigue strength of concrete. It has very high tensile strength of 1700N/mm². Steel fibres are incorporated in the shotcrete to improve its crack resistance, ductility and energy absorption and impact resistance characteristics.

Applications

Industrial Flooring Warehouses Overlays Tunneling

2. Polypropylene fibre:

They are having good resistance against shrinkage and temperature cracks. It is having low modulus. They have longer elongation under a given load, which means they can absorb more energy without fracture.

The low modulus fibres can be combined with steel fibres which is the latest trend what we call hybrid technology. Its applicable for structure exposed to atmosphere. These fibres can take care of the drying shrinkage where as steel cannot perform in wet condition.

Applications:

Area of application: Polypropylene fibres can be used for slabs on grade, airport, highways, pavement, parking areas, bridge deck overlays, sewer pipes, precast concrete products.

3.Asbestos

Asbestos is mineral fibre and has proved to be most successful of all fibres as it can be mixed with Portland cement. Tensile strength of asbestos varies between 560 to 980N/mm². The composite product called asbestos has considerably higher flexural strength than the Portland cement paste. For unimportant fibre concrete, organic fibres like coir, jute, cane splits are also used.

Uses are : Sheet pipe, boards, sewer pipes, wall lining etc.

4.Carbon:

Carbon fibres perhaps possess very high tensile strength 2110 to 2815 N/mm² and young's modulus. It has been reported that cement composite made with carbon fibre as reinforcement will have very high modulus of elasticity and flexural strength. Carbon fibres concrete are used to construct structures like cladding, panels and shells.

5.Glass Fibre

- O Glass fibres have a density that is similar to that of concrete.
- O It gives better bond between the concrete matrix and the reinforcement.
- O It prevents crack.

The fibres also have elastic modulus which is significantly higher than concrete. This enables the fibres to provide an effective reinforcement during the hardened stage of concrete.

Application

Noise Barriers

Water ducts and channels Tunnel lining

Railways.

It has very high tensile strength of 1020 to 4080 N/mm². Glass fibre which is originally used in conjunction with cement was found to be affected by alkaline condition of cement. Therefore, alkaline resistant glass fibre are developed and used.

3.5.1 SULPHUR INFILTRATED CONCRETE

New types of composition have been produced by the recently developed techniques of impregnating porous material like concrete with sulphur. Sulphur impregnation has shown great improvement in strength.

Application of Sulphur - infiltration concrete.

Sulphur – (impregnated) infiltration can be employed in the precast industries. Sulphur infiltration concrete should find considerable use in industry situation where high corrosion resistant concrete is required. This method cannot be conveniently applied to cast-in place concrete. Sulphur impregnation has shown a great improvement in strength. Physical properties have been found and large improvements in water impermeability and resistance to corrosion have been achieved. Sulphur – infiltrated concrete showed more than 4 times increase in splitting tensile strength.