LITERATURE

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2. In blast resistant structures, foundations for machinery where shock and vibrating loads are evident, for refractories where thermal gradient exists, in precast thin elements such as thin folded plates and shells, wall panels, precast roofing and flooring elements, manhole covers, car park deck slab etc.
3. As a biological shielding of atomic rectors and also to water front marine structures such as jetty armour, breakwater caissons etc. which have to resist deterioration at air water surface and impact loading.
4. In under water storage structures, water front wave house floors and wharf decking.
5. Used for repairs and new constructions on major dams and other hydraulic structures to provide resistance to cavitations impact and severe erosion.
6. Used in mining, tunneling and rock slope stabilization by gunite or shortcrete process.

2.6 Structural Use of FRC

As recommended by ACI Committee 544, 'When used in structural applications, steel fiber reinforced concrete should only be used in a supplementary role to inhibit cracking, to improve resistance to impact or dynamic loading, and to resist material disintegration in structural members where flexural or tensile loads will occur…..the reinforcing steel must be +capable of supporting the total tensile load'. Thus, while there is no. of techniques for predicting the strength of beams reinforced only with steel fibers, there are no predictive equations for large SFRC beams, since these would be expected to contain conventional reinforcing bars as well. An extensive guide to design considerations for SFRC has recently been published by the American concrete institute. In this section, the use of SFRC will be discussed primarily in structural members which also contains conventional reinforcements

2.7 Objectuves

The main objective is to study the following properties of fiber reinforced concrete for the aspect ratio of 100 with different volume fraction of fibers as 0.5% and 1%. **1.**Develop suitable mix design **2.**To study the compressive strength **3.**To study the split tensile strength **4.**To study the flexural strength

3. FIBER REINFORCED COCNRETE (Polypropylene Fibers)

3.1 General

FIBRE REINCORCED CONCRETE (FRC), obtained by dispersing in concrete, very small sized reinforcement called fibres. The small closely spaced fibres so used act like crack arresters, substantially improve the static and dynamic strengths. That is the properties like toughness, impact resistance and stiffness under different loading conditions are improved. Naturally the properties of fibres influence the properties of FRC composites. When the fibre reinforcement is in the form of short discrete fibres, they act effectively as rigid inclusions in the concrete matrix. Physically, they have thus the same order of magnitude as aggregate inclusions; steel fibre reinforcement cannot therefore be regarded as a direct replacement of longitudinal reinforcement in reinforced and prestressed structural members. However, because of the inherent material properties of fibre concrete, the presence of fibres in the body of the concrete or the provision of a tensile skin of fibre concrete can be expected to improve the resistance of conventionally reinforced structural members to cracking, deflection and other serviceability conditions.

3.2 Basic Concepts of FRC

All cement based materials are essentially anisotropic and heterogeneous in nature. These contain micro cracks and interfacial discontinuities which are root causes for the propagation of cracks and result in low tensile strength. Such problems caused the evolution of the FRC. The incorporation of short fibres in a relatively brittle cement matrix transforms uncontrolled tensile crack propagation into a slow controlled process. These fibres when provided in adequate proportion, the tensile strains in the concrete can be raised to several folds before failure.

3.3 Effect of Fibers in Concrete

Fibers are usually used in concrete to control plastic shrinkage cracking and drying shrinkage cracking. They also lower the permeability of concrete and thus reduce bleeding of water. Some types of fibers produce greater impact, abrasion and shatter resistance in concrete. Generally fibers do not increase the flexural strength of concrete, so it can not replace moment resisting or structural steel reinforcement. Some fibers reduce the strength of concrete. Some recent research indicated that using fibers in concrete has limited effect on the impact resistance of concrete materials. This finding is very important since traditionally people think the ductility increases when concrete reinforced with fibers. The results also pointed out that the micro fibers is better in impact resistance compared with the longer fibers

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3.4 Classification of Fibers

The natural fibres like jute, coir, horse hair etc. have got low tensile strength and low elastic modulus. By addition of such fibres static strengths are not improved, while the dynamic properties are improved.

The Artificial fibres can be of both low or high tensile strength. For ex. Nylon, Polypropylene, polyethylene have got low tensile strength. Steel, Glass, Carbon have got high strength. The earlier three fibres are suitable for the mains structures as they are lease affected by the corrosion

3.5 Types of Fibers

3.5.1 Polypropylene fibres: The polypropylene fiber-reinforced concrete (PFRC) has provided a technical basis for improving these deficiencies. This paper presents an overview of the effect of polypropylene (PP) fibers on various properties of concrete in fresh and hardened state such as compressive strength, tensile strength, flexural strength, workability, bond strength, fracture properties, creep strain, impact and chloride penetration

3.5.2 Steel fibres: The use of steel fibers has led to the improvement of the concrete's mechanical properties such as material toughness in tension and also durability. Many types of steel fibers are used for concrete reinforcement. Round fibers are the most common type and their diameter ranges from 0.25 to 0.75 mm. Rectangular steel fibers are usually 0.25 mm thick, although 0.3 to 0.5 mm wires have been used in India. Deformed fibers in the form of a bundle are also used. The main advantage of deformed fibers is their ability to distribute uniformly within the matrix.

3.5.3 Glass fibres: The Glass fiber-reinforced concrete uses fiber glass, much like you would find in fiber glass insulation, to reinforce the concrete. The glass fiber helps insulate the concrete in addition to making it stronger. Glass fiber also helps prevent the concrete from cracking over time due to mechanical or thermal stress. In addition, the glass fiber does not interfere with radio signals like the steel fiber reinforcement does.

3.5.4 Nylon fibres:

Synthetic fiber-reinforced concrete uses plastic and nylon fibers to improve the concrete's strength. In addition, the synthetic fibers have a number of benefits over the other fibers. While they are not as strong as steel, they do help improve the cement pumpability by keeping it from sticking in the pipes. The synthetic fibers do not expand in heat or contract in the cold which helps prevent cracking. Finally, synthetic fibers help keep the concrete from spalling during impacts or fires.

3.6 Polyproplyene Fibers

The capability of durable structure to resist weathering action, chemical attack, abrasion and other degradation processes during its service life with the minimal maintenance is equally important as the capacity of a structure to resist the loads applied on it. Although concrete offers many advantages regarding mechanical characteristics and economic aspects of the construction polypropylene fiber-reinforced concrete (PFRC) has provided a technical basis for improving these deficiencies. This paper presents an overview of the effect of polypropylene (PP) fibers on various properties of concrete in fresh and hardened state such as compressive strength, tensile strength, flexural strength, workability, bond strength, fracture properties, creep strain, impact and chloride penetration

Figure No-3.8.1 Polypropylene fibers

Polypropylene fiber is added to concrete during batching. Thousands of individual fibers are then evenly dispersed throughout the concrete during the mixing process creating a matrix-like structure. The performance of fibers depends on both the dosage (kg/m3) and the fibers parameters (tensile strengths, length, diameter and anchorage). A key factor for quality fiber is the relationship between the length and diameter of the fibers. The higher l/d ratio, the better the performance.

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3.6.1 Benefits of Polypropylene Fibers

- → Improves ductility, compressive, flexural and tensile strength
- → Reduces water permeability
- → Improves homogeneity of concrete by reducing segregation of aggregates
- → Improves durability of concrete
- → Replaces or reduces "non-structural steel" in floors, roads and Pavement

3.6.2 Uses of Polypropylene Fibers

- → Increases strength of mortar
- → Used in concretes for tunnels, bridge decks
- → Used for precast concrete blocks
- → Used in pavements and in runways
- → Makes wall surfaces cohesive and less porous

4. MATERIALS

4.1 General

In the present investigation, locally available materials have been used as ingredients for the preparation of concrete specimens. The concrete mixes are designed for strengths 50 N/mm2 as per IS:10262-1982

4.2 Material Selection

The results of various physical tests are reported in methodology for ordinary Portland cement of grade 53 is used in the preparation af al the specimens. The fact that this cement confirms to specifications of IS:12269-1987 standards has been checked as per the results of physical tests recommended by IS:4031-1988. The locally available river sand belonging to zone II of IS:383-1963 has been used as the fine aggregate. For coarse aggregate, 10 mm and downsized granite metal of angular shape is utilized. Keeping in the view the restrictions on the size of the coarse aggregate as recommended in the literature. Ordinary portable tap water is used in the preparation of the concrete. The round type Human Hair fibers wire cut to required size is used as fibers.

4.3 Ingredients of Concrete

Concrete is used extensively as a construction material because of its versatility. It is good in compression, but weak in tension. This drawback can be overcome by providing steel in tension zone. This technique called **"**REINFORCED CEMENT CONCRETE**"**, improves the load carrying capacity of concrete members. At the same time durability of concrete is also important. Durability is mainly affected due to cracks developed by creep and shrinkage. This can be avoided by using certain chemical admixtures. But once a crack develops in the member there are no barriers to stop the propagation of such cracks. In RCC it leads the corrosion of the reinforcement slowly and finally it results in the failure of the structure

4.3.1 Cement

Cements may be defined as adhesive substances capable of uniting fragments or masses of solid mater to a compact whole. Portland cement was invented in 1824 by an English mason, Joseph Aspin, who named his product Portland cement because it produced a concrete that was of the same colour as natural stone on the Isle of Portland in the English Channel. Raw materials for manufacturing cement consist of basically calcareous and siliceous (generally argillaceous) material. The mixture is heated to a high temperature within a rotating kiln to produce a complex group of chemicals, collectively called cement clinker. Cement is distinct from the ancient cement.

4.3.2 Fine and Coarse Aggregates

The problem is more complicated when the fibres are introduced into a concrete rather than a mortar matrix because they are separated not by a fine grained material which can move easily between them, which may lead to bunching of fibres.The uniform fibre distribution is more difficult to achieve as the aggregate size increases from 5mm to 10 mm to 20mm. In a normal concrete mix the particle finer than 5 mm occupy about 54% of the volume

4.3.2.1 Fine Aggregates

River sand passing through 4.75 mm sieve and conforming to grading zone II of IS: 383-1970 was used as the fine aggregate. Normal river sands are suitable for high strength concrete. Both crushed and rounded sands can be used. Siliceous and calcareous sands can be used for production of HSC

4.3.2.2 Coarse Aggregates

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Crushed granite stone with a maximum size of 20 mm was used as the coarse aggregate. The properties of aggregates used

4.3.3 Polypropylene Fibers

Polypropylene Fibers with 0.025 mean diameter (Neglazable)and Length of 25 mm was used at a volume fraction of 0%, 0.5% and 1%.of its weight

4.3.4 Water

The requirements of water used for mixing and curing shall conform to the requirements given in IS: 456-2000. However use of sea water is prohibited. **Water Cement Ratio:**Experience has shown that for a satisfactory for fibre concrete it should contain a mortar volume of above 20% consisting of particles between 5mm to 10mm.(6). The strength of FRC achieved will be maximum when it is cast without any segregation at the maximum water cement ratio. It is found that FRC cast under good control will achieve its maximum strength at water cement ratio around 0.3 to 0.35. But due to the problem of balling at low water cement ratio it is advised to use either increased water cement ratio.

5. METHODOLOGY

5.1 General

This chapter describes the materials used, the preparation of the test specimens and the test procedures. They are listed down in this section.

5.2 Materials

The materials used in this study were cement, sand, aggregates (both fine and coarse) and water. The description of each of the material is described in the following sections.

5.2.1 Cement

Cement used in this study was KCP brand Ordinary Portland Cement of grade 53. The cement was kept in an airtight container and stored in the humidity controlled room to prevent cement from being exposed to moisture. and various tests were conducted as per codal provisions

5.2.1.1 Initial and Final Setting Time

We need to calculate the initial and final setting time as per IS: 4031 (Part 5) – 1988. To do so we need Vicar apparatus conforming to IS: 5513 – 1976, Balance, Gauging trowel conforming to IS: 10086 – 1982

Procedure to determine initial and final setting time of cement

- Take 500gms of Cement sample and gauging it with 0.85 times the water required to produce a Cement paste of standard consistency.
- Start a stop-watch, the moment water is added to the cement.
- Fill the Vicar mould completely with the cement paste gauged as above, the mould resting on a non-porous plate and smooth off the surface of the paste making it level with the top of the mould. The cement block thus prepared in the mould is the test block.
- The temperature of water and that of the test room, at the time of gauging shall be within 27ºC ± 2ºC

  - **Initial setting time**

Place the test block under the rod bearing the needle. Lower the needle gently in order to make contact with the surface of the cement paste and release quickly, allowing it to penetrate the test block. Repeat the procedure till the needle fails to pierce the test block to a point 5.0 ± 0.5mm measured from the bottom of the mould. The time period elapsing between the time, water is added to the cement and the time, the needle fails to pierce the test block by 5.0 ± 0.5mm measured from the bottom of the mould, is the initial setting time.

  - **Final setting time**

Replace the above needle by the one with by a circular attachment. The cement should be considered as finally set when, upon applying the needle gently to the surface of the test block, the needle makes an impression therein, while the attachment fails to do so. The period elapsing between the time, water is added to the cement and the time, the needle makes an impression on the surface of the test block, while the attachment fails to do so, is the final setting time. In other words the paste has attained such hardness that the centre needle does not pierce through the paste more than 0.5 mm

5.2.1.2 Consistency Test

The basic aim is to find out the water content required to produce a cement paste of standard consistency as specified by the IS: 4031 (Part 4) – 1988. The principle is that standard consistency of cement is that consistency at which the Vicar plunger penetrates to a point 5-7mm from the bottom of Vicar mould.

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8. CONCLUSION & FUTURE SCOPE

Fiber reinforced concrete and high strength concrete are being widely used as important constructional materials due to their excellent properties. An extensive knowledge of the properties is necessary in order to make best and economic use of the material. In this context, present experimental investigation aims to find the different strength characteristics of high strength HFRC. (M50)

8.1 Conclusion

Crack formation and propagation are very much reduced showing that hair fibre reinforced concrete can have various applications in seismic resistant and crack resistant constructions, road pavement constructions etc.

- During our research work we also faced the problem of uniform distribution of Polypropylene Fibers in the concrete. So an efficient method of mixing of of Polypropylene Fibers to the concrete mix is to be found out.
- Applications fiber on other properties of composites such physical, thermal properties and appearances.
- In Compressive strength test results the Concrete mix containing 1.0% Steel fibers (C - 3) as maximum improvement of 26.3% is observed.
- In Split Tensile strength test results the Concrete mix containing 1.0 Steel fibers (C - 3) as maximum improvement of 39.9% is observed
- Flexural strength Test results the concrete mix containing 1.0 Steel fibers (C - 3) as maximum improvement of 84.4% is observed.
- For heavy structures in order to decrease secondary reinforcement steel fibers is very much useful.
- In certain critical places the crack penetration can be arrested by using fibers.
- By using polypropylene in concrete, micro crack can be arrested.
- HFRC have more strength in compression ,tension and Flexural Strength test

8.2 Future Scope

The present work leaves a wide scope for future investigators to explore many other aspects of Polypropylene Fibers reinforced concrete composites. Some recommendations for future areas of research include:

- To increase mechanical strength of these composites for their use in different sectors can be studied.
- Possible use of other fibers/flakes obtained from bio-wastes in the development of new composites.
- The use of animal and human hairs in concrete.
- The use of other Natural and Artificial fibers in concrete. To improve the Strength parameters

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