International Journal Of Advanced Research In Engineering Technology & Sciences
ISSN: 2394-2819
Email: editor@ijarets.org March- 2015 Volume 2, Issue-3 www.ijarets.org

Comparative Study of Plain & Fiber Reinforced Concrete

G.R. Siromani
Assistant Professor
Department of Civil Engineering
SRM University NCR Campus
Ghaziabad

Praveen Kumar Sharma, Shailesh Singh, Harsh Deep Prasad, Prashant Yadav
B.Tech Students
Department of Civil Engineering
SRM University NCR Campus
Ghaziabad

ABSTRACT:
This study provides an extensive database and a summary of a comprehensive experimental investigation on the fresh state and mechanical properties of high strength fiber reinforced concrete (HSFRC).The probabilistic analysis of fatigue life data using Weibull distribution. Tests on the mechanical properties include work ability compressive Strength elastic modulus, static flexural strength, flexural strength on Hy FRC have also Presented.

Keywords: Plane concrete, fiber reinforcement, tests, discussion of test results.

I. INTRODUCTION

Plain concrete possesses a very low tensile strength, limited ductility and little resistance to cracking. Internal micro cracks are inherently present in the concrete and its poor tensile strength is due to the propagation of such micro cracks, eventually leading to brittle fracture of concrete. The usefulness of Fiber Reinforced Concrete (FRC) in various civil engineering applications is indisputable. It has successfully been used in structures such as airport and highway pavements, highway bridge slabs, tunnel linings, structure in seismic regions and cavitation and erosion resistance structures. Fibers have been used to reinforce brittle materials since ancient times. Straw was used to reinforce sun-baked bricks, and horsehair was used to reinforced masonry mortar and plaster. In modern times, a wide range of engineering materials including concrete, ceramic, plastics, and cement and gypsum products in corporate fibers to enhance composite properties. The enhanced properties include tensile strength, compressive strength, elastic modulus, crack resistance, shrinkage, expansion, thermal characteristics and fire resistance.

Fibers have been produced from diverse materials viz. steel, plastic, glass, carbon, polypropylene and nylon in various shape and sizes. Steel fiber reinforced concrete (SFRC) has been most commonly used. The common diameter of steel fiber ranges from 0.5mm to 1.0mm and specific gravity of 7.85. Steel fiber shapes include round, oval, polygonal and crescent cross sections. Two types of synthetic fibers have emerged: micro synthetic and macro synthetic. Polypropylene fiber can be either micro-synthetic or macro-synthetic and have a specific gravity of 0.91. During early years, when the concept of FRC was relatively new, major problem was encountered during mixing of the fibers. As the volume fraction in concrete mix increased, fibers were found to ball up during mixing. However, with the addition of admixtures and super-plasticizers and special type of fibers, this problem of balling has been overcome.

II. LITERATURE REVIEW

- Fiber reinforced concrete:

Since ancient time, fiber has been used to reinforce brittle materials. Straw was used to reinforced sun baked bricked bricks, and horse hair was used to reinforce masonry mortar and plaster. In modern times, a wide range of engineering materials including ceramics, plastic, cement and gypsum products incorporate fiber to enhance the composition properties. The composite properties include flexural strength, compressive strength, crack control, durability, and shrinkage and fire resistance.

Fiber reinforced concrete is an enhanced crack resistant and relatively ductile concrete, produced by using different types of fibers like polyester, polypropylene, glass and steel etc. that minimizes the problems of plastic shrinkage cracks of the concrete and sustainability improves its static and dynamic properties like the flexural impact and tensile strength.

- Types of Fibers

There are numerous fiber types available for commercial and experimental use. The basic fiber categories are:-

- Steel fiber
- Glass fiber
- Synthetic fiber
- Natural fiber

Type of fiber	Tensile strength(x 10^3MPa)	Young's modulus(x 10^5MPa)	Ultimate elongation(percent)	Specific gravity
Asbestos	0.56-0.98	0.84-1.40	0.60	3.20
Carbon	2.10-2.80	2.81-4.22	0.5-1.00	2.00
Cotton	0.42-0.70	0.049	3.00-10.00	1.50
Glass	1.05-3.87	0.70	1.50-3.50	2.50
Nylon	0.77-0.84	0.04	16.00-20.00	1.10
Steel	0.28-4.22	2.03	0.50-3.50	7.86

Table 1: Typical Properties of Different Types of Fibres

Steel fiber:

Steel fiber reinforced concrete (SFRC) is a mix of cement, sand, aggregate and discontinuous steel fiber.

Steel fibers have been used in concrete since the early 1900s. The early fibers were round and smooth and the wire was cut or chopped to the required lengths. The use of straight, smooth fibers has largely disappeared and modern fibers have either rough surfaces, hooked ends or are crimped or undulated through their length.

Synthetic fibers:

Synthetic fibers are man-made fibers resulting from research and development in the petrochemical and textile industries. There are two different physical fiber forms: monofilament fibers and fibers produced from fibrillated tape. Currently there are two different synthetic fiber volumes used in application, namely low-volume percentage (0.1 to 0.3% by volume) and high-volume percentage (0.4 to 0.8% by volume). Most synthetic fiber applications are at the 0.1% by volume level. At this level, the strength of the concrete is considered unaffected and crack control characteristics are sought.

III. PLANE CONCRETE

Concrete is the most widely used man-made construction material in the world, the popularity of concrete is due to the fact that form the common ingredient , the properties of concrete are tailored to meet the demand of any particular application.

Tremendous infrastructure development has taken place in the country, and making concrete of strength M30, M60, M80, etc. are now common practice. The discrepancies in the Indian Standard Recommended guidelines for mix proportioning and its nonconformities with the provision of IS : 456-2000 has been identified and where possible, changes have been suggested.

The construction practices are rapidly innovating throughout the world . The pace of infrastructure developments in India requires adoption of new technologies. The hardening is caused by chemical reaction between water and cement and it continues for a long time, and consequently the concrete grows stronger with age. The hardened concrete may also be considered as an artificial stone in which the voids of larger particles (coarse aggregate) are filled by the smaller particles (smaller aggregate) and the voids of fine aggregate are filled with cement . In a concrete mix the cementing material and water form a paste called cement – water paste which in addition to filling the voids of fine aggregate , coat the surface of fine and coarse aggregate and binds them together as it cures , thereby cementing the particles of the aggregate together in a compact mass.

"Concrete has high compressive strength , but its tensile strength is very low . In situation where tensile stresses are developed, the concrete is strengthened by steel bars or short randomly distributed fibers forming a composite construction called Reinforced Cement Concrete (RCC) or Fiber Reinforced Concrete (FRC)." The concrete without reinforcement is termed Plain Cement Concrete is called Concreting.

IV. TEST ON AGGREGATES

- Impact value test
- Flakiness index of coarse aggregates
- Elongation index
- Water absorption and specific gravity of coarse aggregates
- Water absorption and specific gravity of fine aggregates

V. TEST ON CONCRETE

- Compressive strength test
- Flexural strength test

VI. CONCLUSION

- Comparison studies were conducted out on Normal Plain Concrete and Fibre Reinforced Concrete.
- Compressive Strength Test and Flexure Strength Test were conducted on concrete Specimens.
- Compressive Strength of M20 Grade Steel FRC at 28 days is found to be 19.2% higher than that of Normal Plain Concrete.
- It is found that addition of fibers upto a limit increases strength and after that it leads to reduction in strength.
- Addition of Steel Fibers results in increase of Compressive,Flexural,Tensile and Impact Strength of Concrete considerably.
- Compressive Strength of Polypropylene FRC is found to be nearly equal to Normal Plain Concrete.
- Addition of Polypropylene Fibres results only in increase of Impact Strength of concrete.
- Flexural Strength of Steel FRC increased considerably as compared to Plain Normal Concrete.
- Flexural Strength of both type of Concrete came out to be 15% of the Compressive Strength of Concrete.
- On the whole it has been concluded that for heavily loaded structures subjected to higher stresses Fibre Reinforced Concrete should be used for Construction.

REFRENCES

1. IS 383:1970 – Specification for coarse and fine aggregates from natural sources for concrete.
2. IS 456:2000 Code of practice for plain and reinforced concrete.
3. IS 2386(Part 3):1963 Methods of test for aggregates for concrete: Part 3 Specific gravity, density, voids, absorption and bulking.
4. IS 10086:1982 Specification for moulds for use in tests of cement and concrete.
5. IS 516:1959 Method of Tests for Strength of Concrete.
6. C1116/C1116M Specification for Fiber-Reinforced Concrete.
7. IS 9399:1979 Specification for apparatus for flexural testing of concrete.
8. The sampling and strength test of concrete are as per Section 15 of IS:1343 – 1980
9. ASTM C78 / C78M - 10e1 Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading.