A Review Study on Fiber Reinforced Concrete

Harpreet singh[1] Aman kumar[2] Neeraj singh[3] Gaurav kumar[4] Mr. Nitin Kumar[5]
[1,2,3,4]B.Tech Student [5]Assistant Professor
[1,2,3,4,5]Moradabad Institute of Technology Moradabad, UP

Abstract— This paper reviews the uses of fiber reinforced concrete in Engineering field. Fiber reinforced concrete is a special type of concrete with fiber as its reinforced material which can either be Steel fiber, Natural fiber, Glass fiber, Synthetic fiber increases its structural integrity. Fibers include steel fibers, glass fibers, synthetic fibers and natural fibers – each of which lend varying properties to the concrete. In addition, the character of fiber-reinforced concrete changes with varying concretes, fiber materials, distribution, orientation, and densities. Fiber reinforced concrete is a composite material consisting of cement paste, mortar or concrete with closely spaced and uniformly dispersed fibers of polypropylene, nylon, asbestos, coir, glass and carbon (circular or flat) we have focused on replacement of the fine aggregate or cement from the normal concrete to make our concrete adequate economical 7 strong with optimum desired strength. We have change the aggregate to cement to fiber ratio (A/C/F) OF M20, M25, and M30 concrete and tested them for their strength& find out capability to with stand with load.

Key words: Fiber, M20, Concrete

I. INTRODUCTION

Fiber reinforced concrete (FRC) is a new structural material which is gaining increasing importance. Addition of fiber reinforcement in discrete form improves many engineering properties of concrete In the early age, straw and mortar were used for producing mud bricks, and horsehair was used for their reinforcement. As the fiber technology developed, cement was reinforced by asbestos fibers in the early twentieth century.

New materials like steel, glass, and synthetic fibers replaced asbestos for reinforcement. Active research is still in progress on this important technology. Fiber Reinforced Concrete is considered to be one of the greatest advancements in the construction engineering during the twentieth century.

Steel fiber-reinforced concrete is basically a cheaper and easier to use form of rebar reinforced concrete. Rebar reinforced concrete uses steel bars that are laid within the liquid cement, which requires a great deal of prep work but make for a much stronger concrete.

Steel fiber-reinforced concrete uses thin steel wires mixed in with the cement. This imparts the concrete with greater structural strength, reduces cracking and helps protect against extreme cold. Steel fiber is often used in conjunction with rebar or one of the other fiber types.

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 pump ability 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 spilling during impacts or fires.

Historically, fiber-reinforced concrete have used natural fibers, such as hay or hair. While these fibers help the concrete's strength they can also make it weaker if too much is used. In addition if the natural fibers are rotting when they are mixed in then the rot can continue while in the concrete. This eventually leads to the concrete crumbling from the inside, which is why natural fibers are no longer used in construction.

II. LITERATURE REVIEW

Many authors have reported the use of FRC in various civil engineering applications.

Abdul Ghaffar1, Amit S. Chavhan2, Dr.R.S.Tatwawadi3 reported at the purpose of this based on the investigation of the use of steel fibers in structural concrete to enhance the mechanical properties of concrete. The main purpose of the study was to determine and compare the difference between in properties of normal concrete containing without fibers and concrete with fibers.

A cube compression test performed on standard cubes of plain and SFRC of size 15 x 15 x 15cm after 7 days and 14 days of immersed in water of curing plain concrete and SFRC specimens. The compressive strength of specimen was calculated by the following formula:

Fcu = PC/A

Where, Pc = Failure load in compression, KN, A = Loaded area of cube, mm2, Fcu = compressive strength
The main objective of the test is to study the effect of hooked steel fibers on various concrete

Strengths in hardened and wet condition at their various percentages. [1]

Aiswarya Sukumar reported at Fibers are generally used as resistance of cracking and strengthening of concrete. I am going to carry out test on steel fiber reinforced concrete to check the influence of fibers on strength of concrete. According to various research papers, it has been found that steel fibers give the maximum strength in comparison. It was observed that SFRC specimens showed enhanced properties compared to that of normal specimens. Steel fiber reinforcement offers a solution to the problem of cracking by making concrete tougher and more ductile. It has also been proved by extensive research and field trials carried out over the past three decades, that addition of fibers to conventional plain or reinforced and prestressed concrete members at the time of mixing/production imparts improvements to several properties of concrete, particularly those related to strength, performance and durability. The fibers are able to prevent surface cracking through bridging action leading to an increased impact resistance of the concrete.

The addition of steel fibers to concrete considerably improves its properties of concrete in the hardened stage such as flexural strength, impact strength, tensile strength, ductility and flexural toughness. [2]

Amir M. Alani reported at steel and natural fibers are the two most commonly used fiber concretes in the world. Their mechanical properties have therefore become very important in light of the rapid transformation in their application. Various studies have covered different mix designs, fiber volumes and aspect ratios but still there is a considerable gap in knowledge about the behavior of concrete reinforced with these types of fibers. This study is therefore based on the comparative mechanical behavior of the steel and natural fiber concrete types in the same mix design and fiber weight after 7, 14 and 28 days with respect to their performance in flexure, compression and tensile splitting. , the use of Fiber-Reinforced Concrete (FRC), derived by the combination of steel or synthetic fibers and plain-concrete, is gradually gaining ground in civil engineering and structural applications due to its beneficial mechanical properties. [3]

Amit Rai and Dr. Y.P Joshi reported that FRC is an effective way to increase toughness, shock resistance and resistance to plastic shrinkage cracking of the mortar. These fibers have many benefits. Steel fibers can improve the structural strength to reduce the heavy steel reinforcement requirement. Freeze thaw resistance of the concrete is improved. Durability of the concrete is improved to reduce in the crack widths. Polypropylene and Nylon fibers are used to improve the impact resistance. Many developments have been made in the fiber reinforced concrete and Fiber addition improves ductility of concrete and its post-cracking load-carrying capacity [4]

A.M. Shende et. al. Introduced Steel fibers of 50, 60 and 67 aspect ratio. Result data obtained has been analyzed and compared with a control specimen (0% fiber). A relationship between aspect ratio vs. Compressive strength, aspect ratio vs. flexural strength, aspect ratio vs. Split tensile strength represented graphically. It is observed that compressive strength, split tensile strength and flexural strength are on higher side for 3% fibers as compared to that produced from 0%, 1% and 2% fibers. All the strength properties are observed to be on higher side for aspect ratio of 50 as compared to those for aspect ratio 60 and 67. It is observed that compressive strength increases from 11 to 24% with addition of steel fibers. [5]

A.M. Shende1, A.M. Pande2, M. Gulfam Pathan3 reported at Concrete is most widely used construction material in the world due to its ability to get cast in any form and shape. It also replaces old construction materials such as brick and stone masonry. It also replaces old construction materials such as brick and stone masonry. The strength and durability of concrete can be changed by making appropriate changes in its ingredients like cemetitious material, aggregate and water and by adding some special ingredients. Hence concrete is very well suitable for a wide range of applications. The material used for this experimental work is cement, sand, water, steel fibers. Cement: Ordinary Portland cement of 53 grade was used in this experimentation conforming to I.S. – 12269-1987.

Sand: Locally available sand zone II with specific gravity 2.65, water absorption 2% and fineness modulus 2.92, conforming to I.S. – 383-1970.

Coarse aggregate: Crushed granite stones of 10 mm size having specific gravity of 2.70, fineness modulus of 2.73, conforming to IS 383-1970

Water: Potable water was used for the experimentation.

For compressive strength test, cube specimens of dimensions 150 x 150 x 150 mm were cast for M20, M25and M30grade of concrete. Super plasticized (0.6% to 0.8% by weight of cement) was added to this. The mounds were filled with 0%, 1% 2% and 3% fibers. After 24 hours the specimens were demoded and were transferred to curing tank wherein they were allowed to cure for 28 days. After 28 days curing, these cubes were tested on digital compression testing machine as per I.S. 516-1959. The failure load was noted. [6]

G. Moral et. al. studied the influence of addition of waste materials like lathe waste, soft drink bottle caps, empty waste tins, waste steel powder from workshop at a dosage of 1% of total weight of concrete as fibers. The lathe waste, empty tins, soft drink bottle caps were deformed into the rectangular strips of 3mm width and 10mm length. Experimental investigation was done using M25 mix and tests were carried out as per recommended procedures by relevant codes. The results were compared with conventional concrete and it was observed that concrete blocks incorporated with steel powder increased its compressive strength by 41.25% and tensile strength by 40.81%. Soft drink bottle caps reinforced blocks exhibited an increase in flexural strength of concrete by 25.88%. The specimen with steel powder as waste material was found to be good in compression which had the compressive strength of 41.25% more than the conventional concrete. [7]

R. Kandasamyand R. Murugesan studied the influence of addition of polythene fibbers (domestic waste plastics) at a dosage of 0.5% by weight of cement. The properties studied include compressive strength and flexural strength. The studies were conducted on a M20 mix and tests have been carried out as per recommended procedures of relevant codes It was concluded that it increases the cube compressive strength of concrete in 7 days to an extent of 0.68%, increases the cube compressive strength of concrete in 28 days to an extent of 5.12%, increases the cylinder compressive strength of concrete in 28 days to an extent of 3.84% increases the split tensile strength to an extent of 1.63% and the increase in the various mechanical properties of the concrete mixes with polythene fibers is not in same league as that of the steel fibers. [8]

S. Mindess reported at Fibers has been used to reinforce materials that are weaker in tension than in compression since ancient Times. Today, FRC is very widely used, with annual production now approaching about 100 m3 the principal applications are slabs on grade, shot Crete, and precast members, as well as a number of specialty applications. While fibers can improve the pre-peak mechanical properties of concrete, particularly when used at high fiber volumes (>2% by volume), their principal role is to control the cracking of the FRC, and then to modify the behavior of the composite once the concrete matrix has cracked. For instance, the Japan Concrete Institute has published a method for determining the compressive toughness of FRC, JSCE SF5: Method of Test for Compressive Strength and Compressive Toughness of Steel Fiber-Reinforced Concrete. [9]

III. DISCUSSIONS

In this paper we studied the steel fiber or jute fiber as the replacement of fine aggregate in concrete mixture in proportion (2%) respectively after which we compare the compressive strength of concrete having different concrete mix. These fiber reinforced concrete can also be used in roads, yards, buildings etc.

We have focused on replacement of the fine aggregate or cement from the normal concrete to make our concrete and tested them for their strength& find out capability to with stand with load and also compare normal conventional concrete with fiber reinforced concrete. It can also be used for the fabrication of precast products like pipes, boats, beams, stair case steps, wall panels, roof panels, manhole covers etc.

IV. CONCLUSION

1) By increasing the content of fiber to some extent compressive strength of concrete mix increases
2) FRC for a wide variety of applications, and FRC has become very much a mainstream construction material.
3) Fiber used in concrete acct as binding material. Fibber increases the binding property of concrete
4) Steel fiber provide less binding property comparison to natural (jute) fiber, due to its density
5) FRC applications would still be considered to be primarily in non-structural applications (industrial floors, thin-sheet materials, fiber shot Crete tunnel linings, and so on.
6) FRC is used in parking, flooring, and cement- concrete pavement.
7) Areas near to sea shore, find application of NFRC instead of SFRC because of corrosion free property
8) Fiber reinforcement has sufficient strength and ductility to be used as a complete replacement to conventional steel bars in some types of structures; foundations, walls, slabs.
9) From the test results of compressive strength, split tensile strength and flexural strength, it can be seen that, in the presence of steel fiber there is an increase in compressive strength, split tensile strength and flexural strength.
10) It is observed that compressive strength, split tensile strength and flexural strength are on higher side for 3% fibers as compared to that produced from 0%, 1% and 2% fibers.
11) It is observed that compressive strength increases from 11% to 24% with addition of steel fibers.
12) It is observed that flexural strength increases from 12 to 49% with addition of steel fibers.
13) It is observed that split tensile strength increases from 3 to 41% with addition of steel fibers.

REFERENCES

[1] International Journal of Engineering Trends and Technology (IJETT) – Volume 9 Number 15 - Mar 2014
[2] Department of Civil Engineering, University of British Columbia, Vancouver, B.C., Canada.
[3] Aiswarya Sukumar Elson John, M.Tech CE, MACE Jasso. Professor, MACE MG University, Kerala MG University, Kerala ISSN: 2349-2163
[4] Amit Rai and Dr. Y. P. Joshi, "Applications and Properties of Fibre Reinforced Concrete", Int. Journal of Engineering Research and Applications, ISSN: 2248-9622, Vol. 4, Issue 5 (Version 1), May 2014, pp.123-131
[5] A. M. Shende, A. M. Pande and M. Gulfam Pathan, "Experimental Study on Steel Fiber Reinforced Concrete for M-40 Grade", International Refereed Journal of Engineering and Science (IRJES), ISSN (Online) 2319-183X, (Print) 2319-1821, Volume 1, Issue 1 (September 2012), pp. 043-048
[6] ISSN (Online) 2319-183X, (Print) 2319-1821 Volume 1, Issue 1 (September 2012), PP. 043-048,www.irjes.com.
[7] G.Murali, C.M.Vivek Vardhan, R.Prabu, Z.Mohammed Sadaquath Ali Khan, T.Aarif Mohamed and T.Suresh, "Experimental Investigation on fiber Reinforced Concrete Using Waste Materials", International Journal of Engineering Research and Applications (IJERA),ISSN: 2248-9622, Vol. 2, Issue 2, Mar-Apr 2012, pp. 278-283
[8] R. Kandasamy and R. Murugesan, "Fibre Reinforced Concrete Using Domestic Waste Plastics as Fibers", ARPN Journal of Engineering and Applied Sciences, Vol. 6, NO. 3, March 2011, ISSN 1819-6608, pp. 075-082
[9] Volume 1 Issue 8(September 2014) www.ijirae.com International Journal of Civil, Environmental, and Structural, Construction and Architectural Engineering Vol:7, No:9, 2013

