



International Journal of Engineering Research and Science & Technology

www.ijerst.org

ISSN : 2319-5991

Vol. 22 No. 2(1) (2026)



ijerst.editor@gmail.com

editor@ijerst.com

Research Paper

STRENGTH ANALYSIS OF STEEL FIBER REINFORCED SELF COMPACTING CONCRETE

D LATHA¹, S JAGRUTH² M NITHISH KUMAR³, SHAIK SHABAZ⁴, S MANOJ KUMAR⁵ Ch. VIGNESH⁶

¹Assistant Professor Department of Civil Engineering, Vijay Rural Engineering College, Vijay Rural Engineering College, Rochis Valley, Manikbhandar, National Highway 16, Borgaon Nizamabad, TG - 503 003

^{2, 3, 4, 5, 6}UG Scholar, Department of civil engineering, Vijay Rural Engineering College, Vijay Rural Engineering College, Rochis Valley, Manikbhandar, National Highway 16, Borgaon Nizamabad, TG - 503 003

ABSTRACT In construction industry the cementations substances are one of the most required and used materials. These cement based materials are easily treated and prepared into required designed shapes and structural configurations at an early stage, i.e. earlier than the curing process. However the major weak spot of these cement based materials is their brittleness, associated with their rigid properties, which is responsible for the formation of cracks and in addition to propagation when subjected to stresses. Such weak spot leads to the deterioration of their mechanical properties, which suggests costly maintenance or even reconstruction of such materials in a relatively short existence time. Hence, new cement based substances with higher durability properties, for instance, that provide higher cracking resistance, are needed in the constructing industry. Since historic time, fiber reinforced concrete has been replaced with plain concrete which is brittle material. Although, the involvement of single type fiber may improve mechanical properties of concrete, the hybridization can compensate the disadvantages of 2 fiber types and represent their advantages. The impact of using glass fiber and polypropylene fiber for reinforcing the concrete to quantify the mechanical properties of concrete matrix explores in this thesis.

In the present study an experimental investigation was conducted on M30 grade concrete by using steel, fibers. The steel fibers are used at the dose of 0%, 0.25%, 0.5%, 0.75%, 1%, 1.25% and 1.5%. The strength values related to compressive strength, split tensile strength and flexural strength are determined at the age of 7days, 14days and 28 days curing period.

1. INTRODUCTION

By and by a day's human essential is significantly higher than shield, with the movement of human social requests, structure must be more bound in space occupation, broad and more grounded than some time as of late. Present day structures are made with flawless appearance just as for long life and quality. Move development in basic structure and in building urges organizers and experts to appear and quality. Beside nature's impact like in sort of big enchiladas, flood and seismic quake; structures moreover withstand in ecological condition like

tempest, soggy and tremendous assortment in temperature as demonstrated by climate. In the current work we moreover investigated various roads with respect to steel fibers and various fixings (Steel fiber). Test with different obsession and assorted size of fiber, were organized and pursued for the compressive quality against customary concrete.

Data from the performed investigate were recorded and compressive quality related assessment have been done. Our basic inquiry of the work is to upgrade the Fiber sustained concrete (FRC) is Portland bond concrete reinforced with essentially aimlessly appropriated fibers. In FRC, a colossal

number of little strands are dissipated and appropriated indiscriminately in the strong in the midst of mixing, and thusly upgrade strong properties all over. FRC is concrete based composite material that has been made recently. It has been successfully used as a piece of advancement with its radiant flexural-flexibility, insurance from spitting, influence assurance and incredible permeability and ice security. It is a convincing way to deal with construct solidness, daze insurance and assurance from plastic shrinkage breaking of the mortar. Fiber is a tad of fortifying material having certain traits properties.

Steel fiber reinforced concrete (SFRC)

Steel fiber fortified concrete is a composite material having fibers as the additional fixings, dispersed reliably at sporadic in little rates, for example in the region of 0.3% and 2.5% by volume in plain concrete SFRC things are delivered by adding steel fibers to the components of concrete in the blender and by trading the green concrete into molds. The thing is then compacted and relieved by the standard procedures. Separation or balling is one of the issues experienced in the midst of mixing and compacting SFRC. This should be kept up a key good ways from for uniform appointment of strands. The essentialness required for mixing, passing on, putting and finishing of SFRC is possibly higher. Usage of compartment blender and fiber device to help better mixing and to decrease the plan of fiber balls is essential. Additional fines and confining most outrageous size of sums to 20mm once in a while, bond substance of 350 kg to 550 kg for each cubic meter are ordinarily required.

Objectives of the study

For this study the following objectives were made

1. To study the shear behavior of fiber reinforced concrete using M30 grade of concrete.
2. To determine the optimum dosage of steel fiber.
3. To study the mechanical properties like Compressive strength, Split tensile strength.
4. To study the shear behavior of FRC

2. LITERATURE REVIEW

AnandM,et al., (2017), . Hybrid fiber reinforced concrete with different proportions was tested for compressive strength, split tensile and flexural strength for M40 grade of concrete. Normal concrete, M40 grade was taken as control With the same grade of concrete hybrid fiber reinforced viz., 0.0%, 0.5%, 1.0%, 1.5% and 3.0 % and the same were examined for compressive strength, flexural strength.

S. Sharmila (2013) et al.

This research paper explains the “Behavior of reinforced concrete flexural member with hybrid fiber under cyclic loading”. The first crack load carrying capacity of SFRC and HFRC has been increased by 40% than that of conventional concrete. The cumulative ductility factor of SFRC and HFRC beam is about 1.7 & 1.8 times that of conventional beam. Cumulative energy absorption capacity of SFRC & HFRC beam is about 1.77 & 2.62 times that of conventional beam. In general, it is concluded that the effect of adding hybrid fibers influence the behaviour of beams by increasing the ductility characteristics by 80% and energy absorption characteristics by more than 160%. Instead of adding single fibers, the combination of different types of fibers (Hybrid fibers) increases the energy absorption capacity substantially.

Senali (2014) et al.

This research paper explains the “Influence of hybrid fiber on reinforced concrete”. The Compressive strength of HFRC (S0.7P0.25) was increased by 75% and 25% over NC. The Split tensile strength of HFRC (S0.7P0.5) shows slight increase in strength.

B.Barr (1987) et al.

This research paper explains the Shear performance of fiber reinforced concrete materials. Three types of fibers (steel, polypropylene and glass fiber) have been used to study the shear performance of fiber reinforced concrete specimens using double notched specimens. Shear performance of fiber reinforced concrete has been increased by the addition of fibers by weight.

3. MATERIALS USED AND MIX DESIGN

Cement

Ordinary Portland cement of 53 grade was used in this experimentation conforming to I.S. – 12269-1987.



OPC 53 grade cement

Fine aggregates

Locally open sand zone II with specific gravity 2.65, water absorption 2% and fineness modulus 2.92, changing in accordance with I.S. – 383-1970. It is the aggregate the lion's share of which passes 4.75 mm



Fine aggregates

Coarse aggregates

Crushed stone aggregate of 20mm size is brought from nearby quarry. Aggregates of size more than 20mm size are separated by sieving. Tests are carried in order to find out the

- Specific gravity = 2.98
- Fineness modulus = 7.5



Coarse aggregates

Steel fibres

Stainless steel wire of 0.5 mm distance across has been utilized as a part of the arrangement of SFRC. The steel fiber of length 40 mm and of perspective proportion 80 has been utilized as a part of this exploratory work. All the steel filaments are tied down, snared, disintegrated fit as a fiddle. The run of the mill distance across lies in the scope of 0.25-0.75 mm snare end steel strands are being utilized as a part of this undertaking. Length of these strands is 30 mm and the angle proportion of 55. Thickness of steel fiber is 7900 kg/cum



Steel fibre of (a) anchor steel fibre (b) hooked end steel fibre (c) reinforced steel fibre (d) recycled steel fibre

Mix Design of M30 grade

Final trial mix for M30 grade concrete is 1:1.86:2.89 at w/c of 0.50

Mix Trials Used in the study

1. M0 – 0% steel fibers
2. M1- 0.25% steel fibers
3. M2- 0.5% steel fibers
4. M3- 0.75% steel fibers
5. M4- 1% steel fibers
6. M5- 1.25% steel fibers
7. M6- 1.50% steel fibers

TEST TO BE CONDUCTED ON THE SPECIMENS:

Compressive strength

- 7 days specimens age
- 14 days specimens age
- 28 days specimens age

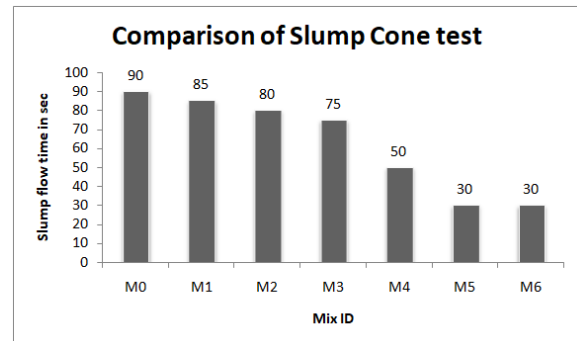
Split tensile strength of specimens

- 7 days specimens age
- 14 days specimens age

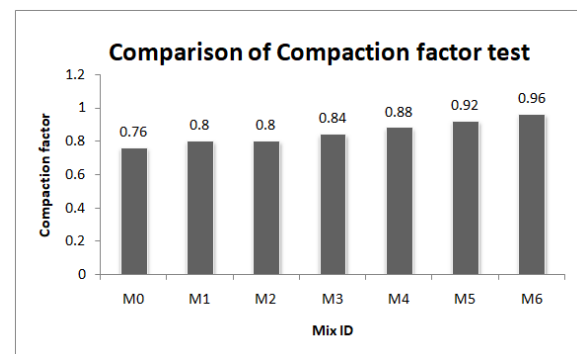
- 28 days specimens age

4. RESULTS AND ANALYSIS

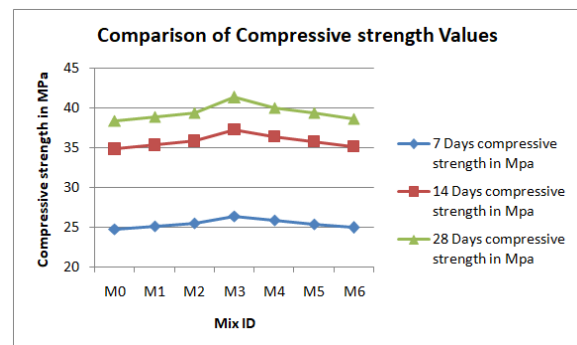
Slump in mm



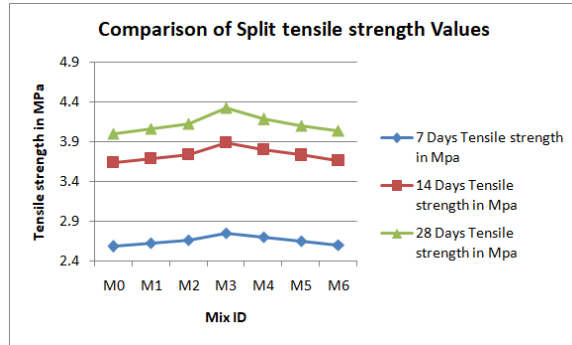
Compaction factor



Compressive strength of concrete



Split tensile strength of concrete



5. CONCLUSIONS

From the above experimental investigation the following conclusions were made

1. The use of steel fibres in replacing cement definitely increases the fundamental properties of concrete but could only be done up to a certain percentage after which the concrete starts to loose strength.
2. Use of fibres reduce workability of concrete and hence could only be used in little amount.
3. Improvement in the surface integrity and reduction in bleeding is observed in most of the cases when using fibre reinforced concrete.
4. The brittleness of concrete could be improved with addition steel fibres and not so much with glass fibres.
5. As the ratio of steel fibers in M30 grade concrete increases, the severity of the slump cone value decreases.
6. As the ratio of steel fibers in M30 grade concrete grows, so does the severity of the compaction factor value.
7. The best value for compressive strength values related to compressive strength, split tensile strength, and flexural strength was found at the M3 mix, which contains 0.75% of glass fibers and 0.75 percentages of steel fibers after curing for 7, 14, and 28 days.
8. The optimal value for tensile strength values related to compressive strength, split tensile

strength, and flexural strength was found at the M3 mix, which contains 0.75% of glass fibers and 0.75 percentages of steel fibers after curing for 7, 14, and 28 days.

REFERENCES

- [1].Pammar R. P. and Ramesh V. " Experimental study on combined effect of steel and glass fibers on compressive strength, flexural strength and durability of concrete and comparison with conventional concrete" International journal of civil and structural engineering research Vol. 3, Issue 1, pp: 146-150 2015
- [2].M.C. Guru Prasad, K.Tanuja and N.Vasu Deva Naidu, "Experimental study & strength of concrete by using steel & glass fibers" International Research Journal of Engineering and Technology (IRJET) Vol. 03, Issue 9, 2016
- [3].Tejas R Patil and Ajay N. Burile, "Comparative study of steel and glass fiber reinforced concrete composites" International Journal of Science and Research (IJSR), ISSN (Online): 2319-7064, 2015
- [4].Kene S. K., Vairagade S. V. and Sathawane S. "Experimental study on behavior of steel and glass fiber reinforced concrete composites", "International research journal of engineering and technology (IRJET) Volume: 02 Issue 04 (2015) pp 129-133
- [5].Ragi S. "A comparative and experimental study on the mechanical properties of various steel and glass International Research Journal of Engineering and Technology (IRJET)

- e-ISSN: 2395-0056 Volume: 05 Issue: 02 | Feb-2018
- [6]. Yasir Khan, M Anwar Ansari, Md. Saroj, Shahnewaj Haider, Sachin Kulkarni and Gunderao .V. Nandi, “Experimental Investigation on Strength and Durability properties of Steel and Glass fibre reinforced concrete composite” IJARSET Vol. 3, Issue 6, 2016
- [7]. A. Upendra Varma and A.D. Kumar, “Glass Fibre Reinforced Concrete” ISSN : 2248-9622, Vol. 3, Issue 5, Sep-Oct 2013, pp.1914-1918
- [8]. J.D. Chaitanya Kumar, G.V.S. Abhilash, P.Khasim Khan, G.Manikanta Sai and V.Taraka Ram, “Experimental Studies on Glass Fiber Concrete”, American Journal of Engineering Research (AJER) Volume-5, Issue-5, pp-100-104, 2016
- [9]. Elavarasi.D (2014), “Structural behaviour of High Strength Steel Fibre Reinforced Concrete (HS-SFRC) block pavement”, International Journal of ChemTech Research, Vol.7, No.4, pp 1790-1794, 2014-201.
- [10]. Abhay Mahadeorao Shende, Dr. Anant M. Pande (2011) “Comparative Study on Steel Fiber Reinforced cum Control Concrete” International Journal of Advanced Engineering Sciences and Technologies(IJAEST).
- [11]. Y. Mohammadi a, S.P. Singh b,*, S.K. Kaushik (2008) “Properties of steel fibrous concrete containing mixed fibres in fresh and hardened state “ Construction and building Materials journal pp. 965 – 965.
- [12]. Nagarkar,P.K., Tambe,S.L.,(1987)“Study of fibre reinforced concrete proceedings of the international symposium on fibre reinforced concrete, Chennai , pp 2.56 –2.72.
- [13]. Mr. Kolase Pramod K , Mr. Shivamant, Dr. Atul K. Desai, Mr. Randhavane Shrikant B. “Steel Fiber Reinforced Concrete Pavement: A Review” IJIRST – International Journal for Innovative Research in Science & Technology| Volume 1 Issue 10 (March 2015) ISSN (online): 2349-6010
- [14]. R. Vengadesan1, S. Divya, Trichy, S. Vijipriya, Namakkal R. Anbarasi. “Experimental Study on Flexural Behavior of Self Compacting Concrete using Steel Fiber” IJERT ISSN: 2278-0181 IJERTV5IS060686 Vol. 5 Issue 06, June-2016