International journal of advances in engineering and management (IJAEM)
Volume 3, issue 6 June 2021, pp: 2525-2526 www.ijaem.net ISSN: 2395-5252

An Experimental Study on Flexural Strength of Concrete Using Steel and Glass Fiber

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Submitted: 10-06-2021 Revised: 20-06-2021 Accepted: 23-06-2021

ABSTRACT

This research work investigates the effect of the addition of steel and glass fibers in design mix M25 based concrete. Steel fiber having length of 30mm and diameter 0.75mm, well crimped and glass fiber length of 20mm was used. Three specimens were cast having same percentage ratio of both steel and glass fibers. Based on experimental studies, the paper identifies fibers combination demonstrate maximum flexural strength. Flexural test were performed and results were analyzed with respect to plain concrete (0% fibers). Finally, the results show that introducing fibers to concrete resulted an increase in flexural strength depending on the fibers ratio used.

The use of concrete as a structural material is limited to certain extent by deficiencies like brittleness, poor tensile strength and poor resistance to impact strength, fatigue, low ductility and low durability. It is also very much limited to receive dynamic stresses caused due to explosions. The brittleness is compensated in structural member by the introduction of reinforcement (or) pre-stressing steel in the tensile zone. However it does not improve the basic property of concrete. It is merely a method of using two materials for the required performance. The main problem of low tensile strength and the requirements of high strength still remain and it is to be improved by different types of reinforcing materials.

Fibers are usually used in concrete to control cracking due to plastic shrinkage and to drying shrinkage. They also reduce the permeability of concrete and thus reduce bleeding of water. Some types of fibers produce greater impact, abrasion, and shatter resistance in concrete.

Key word: Steel Fiber, Glass Fiber, Flexural Strength.

I. INTRODUCTION

Fiber reinforced concrete (FRC) is **concrete** containing fibrous material which increases its structural integrity. It contains short discrete fibers that are uniformly distributed and randomly oriented. Fibers include steel fibers, glass fibers, synthetic fibers and natural fibers.

Fiber is a small piece of reinforcing material possessing certain characteristics properties. They can be circular or flat. The fiber is often described by a convenient parameter called "aspect ratio". The aspect ratio of the fiber is the ratio of its length to its diameter. Typical aspect ratio ranges from 30 to 150.

Fibre-reinforcement is mainly used in shotcrete, but can also be used in normal concrete. Fibre-reinforced normal concrete are mostly used for on-ground floors and pavements. Concrete reinforced with fibers is less expensive than conventional reinforcements, while still increasing the tensile strength many times. Shape, dimension and length of fibre is important. A thin and short fibre, for example short hair-shaped glass fibre, will only be effective the first hours after pouring the concrete (reduces cracking while the concrete is stiffening) but will not increase the concrete tensile strength.

Following are the benefits one can obtain of a fibre reinforced concrete:

1. It increases the tensile strength of the concrete.
2. It reduces the air voids and water voids the inherent porosity of gel.
3. It increases the durability of the concrete.

II. LITERATURE REVIEW

[1]Rami H. Haddad and Ahmed M. Asteyate (2001) in this research work he used synthetic fibre Nylon and polypropylene for delaying corrosion and improving bond strength. He found that polypropylene fibre more significant role than nylon fibre in the improvement of bond.

[2] CB Kukreja and sanjeev chawla [I989] the influence of fibers shape on flexural strength were studied. In this 3 different shape namely straight,

bent and crimped was used varying volume percentages.0.5, 1, 1.5.

[3] Shende.A.M. Pande.A.M. 2010 It is observed that flexural strength increases from 13 to 48.35% through utilization of steel fibers. And through utilization of 1% steel fibers flexural strength increases from 13.35 to 23.35%.Through utilization of 2% steel fibers flexural strength increases from 18.35 to 31.65%.Through utilization of 3% steel fibers flexural strength increases from 20.80 to 48.35%.

[4] Chandramouli K.1 , Srinivasa Rao P.2 , Pannirselvam N.3 , Seshadri Sekhar T.4 and Sravana P.2 In this research, researcher worked on both compressive, flexural and split of concrete using glass fibre 0.3 percentage with different grade on 28,56,90,180 days of concrete and did comparative study on with and without glass fibre effect in the property of concrete.

These values for flexural observed varied from 3.52 to 5.42 N/mm2 for M20 for 28 days.

[5] H.M.Tanarslan2017 a minimum increase of 32% and a maximum of 208% at load carrying capacity was obtained from the UHPFRC strengthened specimens. Consequently, UHPFRC laminate usage is an effective technique to enhance the behavior and the load carrying capacity of RC beams and can be preferred to strengthen deteriorated structures.

MAJOR FINDINGS FROM LITERATURE REVIEW

Flexural behavior of fiber concrete was observed by different researchers.

- The flexural strength of concrete beam is increased by utilization of 1% steel fibers flexural strength increases from 13.35 to 23.35%.
- The flexural, compressive and split values varied after using glass fibre 0.3% with different grade of concrete on 28, 56, 90,180 days .The increase in compressive strength for all the grades of concrete mixes at 56, 90, 180 days are observed to be 20 to 25% when compared with 28 days strength. The flexural values of ordinary concrete and glass fibre concrete mixes are observed to be varied from 3.52 to 5.42 N/mm2 ; 4.08 to 6.23 N/mm2 for 28 days.
- The influence of fibers shape on flexural strength was studied. In this 3 different shape namely straight, bent and crimped was used varying volume percentages.0.5, 1, 1.5.

It is observed that research work is available in steel and glass fibre and there is a scope of work in this area.

III. CONCLUSIONS

It is observed that addition of fibers enhanced the flexural property at different percentage ratio of fibers on 0% average of all 3 specimens is observed stress 6.64 N/mm2 , fibers on 0.5% average of all 3 specimens is observed stress 6.72 N/mm2, fibers on 1.5% average of all 3 specimens is observed stress 7.68 N/mm2 , fibers on 2% average of all 3 specimens is observed stress 8.22 N/mm2 .

- The use of fibers help in modifying properties both in the plastic as well as hardened stage of concrete, thus making concrete a more versatile material to be used for variety of applications.
- Fibers control cracking due to plastic shrinkage and drying shrinkage.
- It reduces the permeability of concrete and thus reduces bleeding of water.
- The flexural strength of horizontal member of a structure can be enhanced using one or more fiber material in different ratio.
- Fibers concrete technology has proved to be better than conventional technologies and it enhance the life time of a structure by more than the expected value.

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