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RESEARCH ARTICLE

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A STUDY ON EFFECT MECHANICAL AND IMPACT PROPERTIES OF FIBRES ON M20 AND M40 GRADE OF CONCRETE

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ABSTRACT

Concrete is most widely used construction material in the world. Nowadays the world is witnessing the constructions of more and more challenging and difficult Engineering structures. Fiber reinforced concrete (FRC) is a concrete in which small and discontinuous fibers are dispersed uniformly. The fibers used in FRC may be of different materials like steel, G.I., carbon, glass, aramid, asbestos, polypropylene, jute etc. Generally, fibers used in concrete are to control cracks, shrinkage. Fibers also show excellent resistance towards impact. The addition of these fibers into concrete mass can dramatically increase the compressive strength, tensile strength and impact strength of concrete. FRC has found many applications in civil engineering field. Based on the laboratory experiment on fiber reinforced concrete (FRC), cube specimens have been designed with steel fiber reinforced concrete (SFRC) containing fibers of 0% ,0.5%,1%and 2% volume fraction of hook end Steel fibers. As same as glass fibers containing 0%, 0.5%, 1%and 2% were used without admixture. Comparing the result of FRC with plain M20, M40 grade concrete, this paper validated the positive effect of different fibers with percentage increase in compression and splitting improvement of specimen 28 days, analyzed the sensitivity of addition of fiber to concrete with different strength. Glass Fiber Reinforced Concrete (GFRC) is a recent introduction in the field of concrete technology. GFRC has advantage of being light weight, high compressive strength. The aim of the work is to study the properties of effect of glass fibers as reinforcement in concrete for different proportions. Compression test are conducted on several cubes to measure the effect of steel and glass fibers on compressive strength of concrete. Similarly tension and impact test.

Key words: Steel Fibres, Glass Fibres, Compressive Strength, Tensile strength and Impact strength.

INTRODUCTION

Fibre Reinforced Concrete plays a very important role in structural engineering applications. Concrete is subjected to high temperature during fire accidents, natural disasters. Even though concrete is the most available material for construction. It has some limitations like loss in strength, loss of weight, shrinkage, expansion, etc.

The application of cement Concrete is limited due to the characteristics of brittle material. This can be avoid by the inclusion of a small quantity of short and randomly distributed fibres such as Glass and Steel. The behaviour of Concrete

when subjected to high temperatures have been studied since few decades and these studies indicates the strength deterioration with an increase in exposure to temperature.

In study an attempt has been made to study the effect of glass and steel fibres its tensile and compressive strength. The strength and durability of Concrete can be changed by making appropriate changes in its ingredients. Concrete is a composite material made with aggregates such as coarse and fine aggregates, cement and water.

Portland cement is the most important ingredient in making concrete. Production of 1 ton of cement emits about 1 ton of carbon dioxide. In order to address the environmental effects associated with Portland cement, there is need to develop alternative binders to make concrete.

Reinforced Concrete is exposed to deterioration in some regions especially in Coastal areas. So, researchers round the world square measure directive their efforts towards developing a brand new material to beat this drawback.

HISTORY FIBRES: In BC horse hair was used. In 1911 Porter found that fiber could be used in concrete. In 1900 hatscheck was used. Composite materials was used in 1950.In 1960 FRC was used. SFRC, GFRC was used in 1970.

STEEL FIBRES: Plain concrete possesses a very low tensile strength, limited ductility and little quarrel to cracking. Internal micro cracks are naturally present in the concrete and its poor tensile strength is due to the propagation of such micro cracks, eventually primary to brittle fracture of the concrete. It has been familiar that the addition of small, closely spaced and evenly dispersed fibers to the concrete would act as crack arrester and would substantially improve its Compressive and flexural strength properties. This type of concrete is known as Fiber Reinforced Concrete.

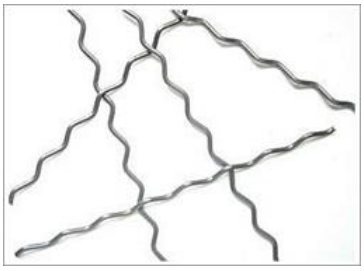


Fig: Steel Fibres

GLASS FIBRES:

It is made of glass, which contains the largest content of zro_2 commercially available .it is used for interior wall and ceiling etc .it is water dispersible strand used for casting process. chopped fibers disperse as filaments in a dilute cement dispersion. It is a alkali resistant glass with nominal diameter 13.5mm and length 13mm with moisture content 7.5+/-5. It is used as a glass fiber reinforced calcium silicate. These were supplied.

Fig: Glass Fibres

OBJECTIVES: The main objectives of the study is to investigate the performance of glass and steel fibres based on concrete with a difference percentages proportion of coarse aggregate. To investigate the hardened properties i.e., compressive, tensile strength and impact strength of concrete for M40, M20 grade of concrete mix. At the same time the it should be noted that only glass and steel fibres have been selected for study.

- Cubes 150mm x 150mm x 150mm casted in water.
- Curing should be properly employed to ensure cementitious materials gain their fully strength.
- At every age the weight of cubes and corresponding compressive strength.
- To find out normal consistency, initial and final setting time, and also the specific gravity of Cement.
- To find out the fine aggregate specific gravity and particle size distribution.
- Produce new conservation mixtures containing different % of steel fibres.
- Produce new conservation mixtures containing different % of glass fibres
- To investigate the mechanical properties such as compressive strength and tensile strength.

- To investigate the impact strength.
- To investigate the behaviour of M20 grade concrete by adding steel fibres and glass fibres.
- To investigate the behaviour of M40 grade concrete by adding steel fibres and glass fibres.
- To compare the behaviour of M20, M40 grade concrete.

CONCRETE MIX DESIGN

TABLE 1: Mix Proportion for M20

Cement (Kg/m^3)	Fine aggregate(Kg/m^3)	Coarse aggregate(Kg/m^3)	Water(lit/m^3)
1	1.62	3.40	0.5
360	584	1223.8	180.42

TABLE 2: Mix Proportion for M40

Cement(Kg/m^3)	Fine aggregate(Kg/m^3)	Coarse aggregate(Kg/m^3)	Water(lit/m^3)
1	1.65	2.92	0.4
400	660	701	160

EXPERMENTAL WORK

COMPRESSION STRENGTH TEST:

The compressive strength test was conducted after 28 days of curing. Standard Cast iron moulds of dimensions 150 x 150 x 150 mm were used to cast the Specimen.

To find the strength of the concrete specimen is as follows:

- The bearing surface of the machine is cleaned.
- Place it under a compressive load using a hydraulic compression machine.
- Place the specimen such that the load is applied on the opposite faces.
- Align the specimen centrally on the base plate of the machine.
- The machine would increase the load onto the concrete cylinder until failure was reached.

Fig: Compressive strength with CTM

SPLIT TENSILE STRENGTH:

- Assuming concrete specimen behaves as an elastic body a uniform lateral tensile stress of ft action alone the vertical plane causes the failure of the specimen ,which can be calculated from the formula, $fbt = pl/bd^2$. where P= load at failure b= width of cube, D= depth of cube and l=length of the cube.
- The loading condition produces a high compressive stress immediately below the two generators to which the load is applied. But the larger portion corresponding to depth is subjected to a uniform tensile stress acting horizontally. The main improvement of this method is that the same type of specimen and the same testing machines as are used for the compression test can be employed for this test. Strength determined in the splitting test is believed to be closer to the true tensile strength of concrete, than the modulus rupture. Splitting strength gives about 5 to 12% higher value than the direct tensile strength.

Fig: Split Tensile Strength Test

IMPACT STRENGTH TEST

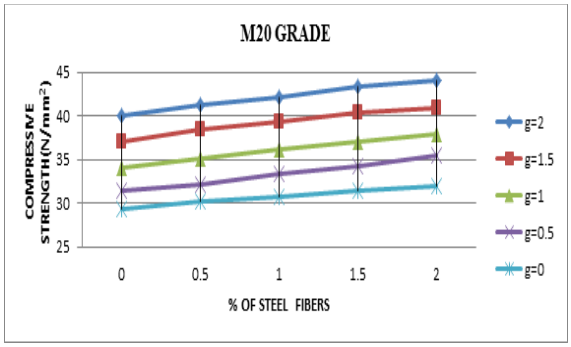
Each series of freshly mixed FRC was placed in the cylindrical moulds of dimensions 15x7.5cm casting the specimens from these cylindrical specimens 18 discs of size 15x7.5cm were cut using a diamond cutter. The discs were than subjected to draw weight test following the guide lines of ACI committee 544.2R89.The test consisted of repeated application of impact load in the form of blows, using 44.5N hammer falling from 457mm height on steel ball of 63.5mm diameter , placed at the center of the top surface of disc .Number of blows (N1) and (N2)that caused the first split strength of the sample. The schematic diagram of drop weight test machine.

The impact test is calculated by using number of blows .By adding 0.5%,1%,1.5% and 2% dosage of crimped steel fibers then increase impact strength .and also by adding 0.5%,1%,1.5%and 2% dosage of glass fibers then increase impact strength. The mode of failure of concrete depends upon the aggregate strength and bond strength of fiber with aggregate. Brittle behaviour was observed in plain concrete specimens and it was broken into two pieces.

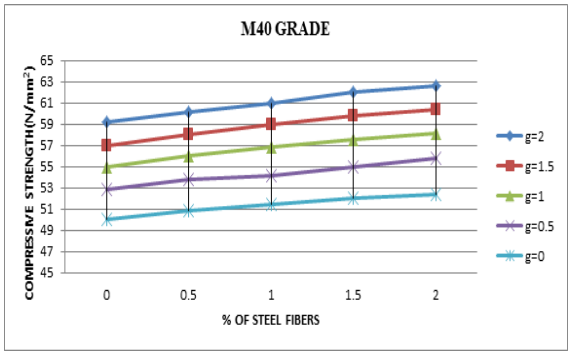
Fig: Impact Strength Test

FINAL TEST RESULTS

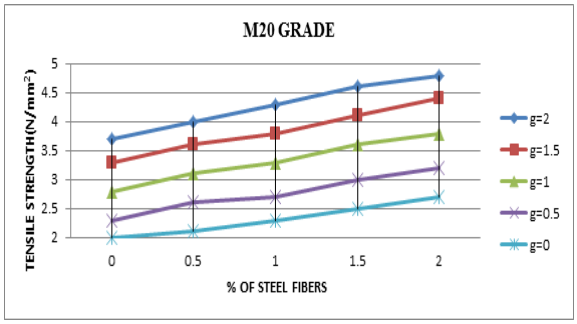
COMPRESSIVE STRENGTH TEST RESULTS FOR M20 GRADE OF CONCRETE:



COMPRESSIVE STRENGTH TEST RESULTS FOR M40 GRADE OF CONCRETE:



SPLIT TENSILE STRENGTH TEST RESULTS FOR M20 GRADE OF CONCRETE:



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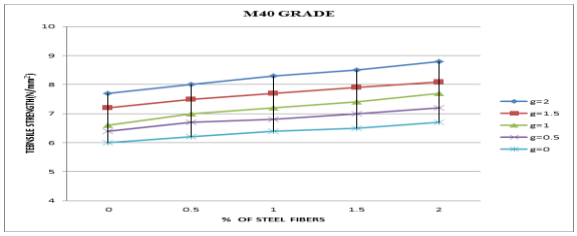
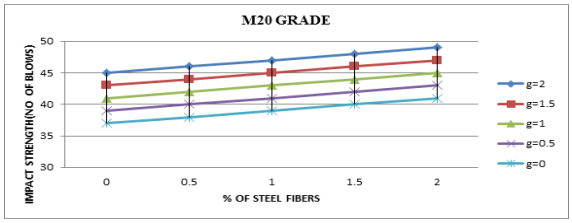
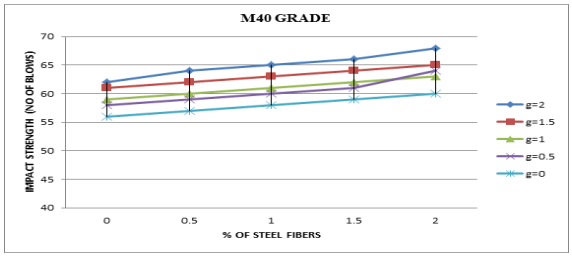


IMPACT STRENGTH TEST RESULTS FOR M20 GRADE OF CONCRETE:



IMPACT STRENGTH TEST RESULTS FOR M40 GRADE OF CONCRETE:



CONCLUSIONS

- By adding steel fibres the compressive strength increased only by 2.6 % to 10 at 0% to 2.0% addition.
- Similarly by the addition of glass fibres there is increase in compressive strength only by 6.8% to 36% at 0% to 2.0% addition at glass fibres.
- Irrespective at grade of concrete addition of steel or glass fibres up to a certain percentage increases the compressive strength.

- Addition of steel and glass fibres to the concrete has increased the tensile strength by 3 to 9% at 0% to 2% of steel fibres by 3% to 11.4% at 0% to 2.0% of glass fibres.
- It is observed that the impact strength increased by 7% to 18.8% by the addition at 0% to 2.0% at glass fibre & by 5.4% to 21.5% by the addition at 0% to 2.0% of steel fibres.
- The addition at steel & glass fibres decrease the workability for all percentages addition of fibres & increases the compressive, split tensile and impact strength at lower percentages of fibres but at large percentages at fibres due to balling effect or due to non-homogeneity at the mix , the decrease in strengths are observed.

REFERENCES

[1]. A Avinash Gornale, B S. Ibrahim Quadri and C Syed Hussaini (2012), Strength aspect of Glass fiber reinforced concrete, International journal of Scientific and Engineering research, vol,3, issue 7.

[2]. A Kavita S. Kene, B Vikrant S. Vairagade and C Satish Sathawane (2012), Experimental study on behavior of steel and glass fiber Reinforced concrete composite, Bonfring International Journal of Industrial Engineering and Management studies, Vol. 2, No-4. 284

[3]. A S. H Alsayed, B Y.A. Al-Salloum and C T. H. Almusallam (2001), Performance of glass fiber reinforced plastic bars as a reinforcing material for concrete structures, Journal of Science and Technology.

[4]. A Yogesh Murthy, B Apoorv Sharda and C Gourav Jain (2012), Performance of glass fiber reinforced concrete, International journal of engineering and innovative technology, vol.1, issue 6.

[5]. Balaguru P and Najm H (2004), "High-performance fibre reinforced concrete mixture proportion with high fibre volume fractions", Material Journal, volume 101, issue 4, July 1, 2004 pp281-286 .

[6]. Bayasi,Z and Zeng,J.(1993) "Properties of polypropylene fibre reinforced concrete""ACI Materials Journal, Novl-Dec 1993, vol. 90 No 6, pp 605-610

[7]. Behavior of concrete beams reinforced with glass fiber reinforced polymer flats, international journal of research in engineering and technology, Vol.2, Issue 09.

[8]. Bhikshma V, Ravande Kishor and Nitturkar Kalidas (2005)," Mechanical properties of fibre reinforced high strength concrete „Recent advances in concrete and construction tech"6-8 Jan 2005, Chennai, pp 23-33.

[9]. BIS 383:1970 Specification for coarse and fine aggregates from natural sources for concrete (second revision).