International Journal of Progressive Research in Science and Engineering
Volume-1, Issue-7, October-2020
www.ijprse.com

Experimental Study of Partially Replacement of Cement by GGBFS and Providing Strengthening to Concrete

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Abstract: - Concrete is the using construction material across the world and the most widely used in all types of civil engineering works, including road building etc. infrastructure, low and high-rise buildings, and local/domestic developments. There is a growing awareness of the advantages of Fibre Reinforcement Concrete construction all over the world. One such development of improving or partially replacement ingredients of concrete. Concrete is by supplementing the concrete matrix with fibre reinforcement. Using crimped fiber who's providing extra strength of concrete In the view of the global sustainable developments, it is imperative that fibres like glass, nylon, steel & coir provide improvements in tensile strength, fatigue characteristics, durability, shrinkage characteristics, impact, cavitation's, erosion resistance and serviceability of concrete. Fibres impart energy absorption, toughness and impact resistance properties to fibre reinforced concrete and these characteristics in turn improve the fracture and fatigue properties of fibre reinforced concrete. The present work shows that the effects of fibres on the behaviour of plastic and hardened concrete vary depending on the concrete materials, mix proportions, fibre type and length, and quantity of fibre added. The present experimental shows that the study of composite concrete with varying percentage of fibres ranging between 1%, 1.5%, 2% ,2.5% and 3% with M30 grade as well as we also replacement of cement by GGBFS at varying percentage 10%,20%,30%,40% and 50% concrete was adopted. Sizes of beam (70*15*15cm) were used for testing. Material can help us to develop infrastructure with elegantly integrated sensing.

Key Words: — GGBFS, Fibre Reinforcement, Concrete.

I. INTRODUCTION

Although concrete is the most utilized building material on earth, this material has a large shortcoming: it has a good resistance against compressive stresses, but a very low resistance against tensile stresses. When loaded in tension, concrete cracks under very low loads, which means that its tensile strength is low. Moreover, once cracked, cracks in concrete widen and propagate very fast: this means that the so-called "ductility" of concrete is very small. The usual way to solve this problem is the application of steel reinforcement in concrete structures. for example, steel or synthetic fibres: this material is then called "fibre concrete". In the past, many types of fibre concrete have been developed. For many of them, the added value of fibres was rather low: no improvement of tensile strength could be achieved, only the ductility was somewhat higher compared to that of plain concrete.

The physical properties of density and strength of concrete are determined, in part, by the proportions of the three key ingredients, water, cement, and aggregate. You have your choice of proportioning ingredients by volume or by weight. Proportioning by volume is less accurate, however due to the time constraints of a class time period this may be the preferred method.

A basic mixture of mortar can be made using the volume proportions of 1 water: 2 cement: 3 sand. Most of the student activities can be conducted using this basic mixture. Another "old rule of thumb" for mixing concrete is 1 cement: 2 sand: 3 gravel by volume. Mix the dry ingredients and slowly add water until the concrete is workable. This mixture may need to be modified depending on the aggregate used to provide a concrete of the right workability. The mix should not be too stiff or too sloppy. It is difficult to form good test specimens if it is too stiff. If it is too sloppy, water may separate (bleed) from the mixture. Remember that water is the key ingredient. Too much water results in weak concrete. Too little water results in a concrete that is unworkable.

A. Objective

The main objectives of this research are:

- To create and optimise the mixture compositions of Fibre Concretes on the basis of their tensile properties and workability.
- To find the appropriate combinations of fibres with GGBFS, which can ensure an optimum tensile response of the concrete, with regard to uniaxial tensile strength, flexural strength, first cracking stress and ductility and also provided binding with GGBFS.
- To be able to model the tensile behaviour of Fibre and GGBFS in Concretes with different

International Journal of Progressive Research in Science and Engineering
Volume-1, Issue-7, October-2020
www.ijprse.com

combinations of fibres with GGBFS in percentage form, on the basis of performed uniaxial tensile tests.

II. MATERIAL

- Cement OPC (Ordinary Portland cement)
- Sand Natural River Sand
- Natural Aggregate
- Conplast SP 430 G8 (admixture)
- Crimped Steel Fibres (MSC 4512.5)
- Ground Granulated Blast Furnace Slag (GGBFS)
- Applied concrete mixtures, mixing sequence

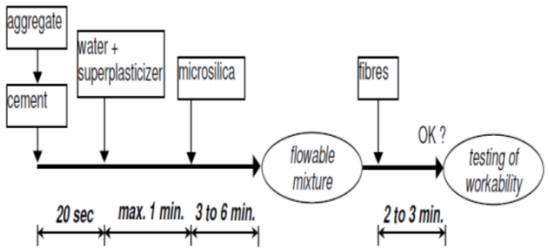

Fig.1. The Mixing Process for CSF Concrete

A. Mix Design M-40 Grade

Concrete mix proportioning guidelines according to IS CODE 10262-2009.

Design a concrete mix for M-40grade of concrete with the following data

a) Grade designation :M40
b) Type of cement: PPC
c) Maximum nominal size of aggregate:20mm
d) Minimum cement content :320Kg/m3
e) Maximum water-cement ratio :0.45
f) Workability :25-50mm(Slump)
g) Exposure condition : Severe (RRC)
h) Method of concrete placing: By Hand
i) Degree of supervision : Good
j) Type of Aggregate: Crushed angular aggregate
l) Maximum cement content : 450kg/m3

Fig.2. Concrete Mix for M-40 (Slump Cone Test of Concrete)

III. TESTING & RESULTS

Concrete is required to be tested in both fresh and hardened states. Fresh concrete is tested for workability to determine its capacity for satisfactory placing. The analysis of fresh concrete is required to judge the stability that is to identify segregation of the concrete mix, uniformity in mixing and to determine the proportions of the ingredients of concrete actually used. The testing of hardened concrete specimens is required for checking the quality and compliance with the specifications.

Quality tests on concrete are performed as a part of quality control of concrete structures. Different quality tests on concrete such as compressive strength tests, slump tests, and permeability tests etc. Are used to assure the quality of the concrete that is supplied for a given specification. Quality tests on concrete are performed as a part of quality control of concrete structures.

A. Testing Performance

The following topics are discussed

- Compressive Strength of concrete
- Hardened of concrete/weight of concrete cube with hardened
- The ability to withstand wear of concrete
- Slum cone test for molding performance
- Allowable tensile of flexural test (twopoint test modular of rapture)

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Fig.3. Testing of Cubes in Laboratory On Compressive Testing Machine

Fig.4. Testing of Cubes in Laboratory On Compressive Testing Machine

B. Results & Discussions

1. Now comparison between average value of cubes and beam at 7 days, 28days curing or tested on machine

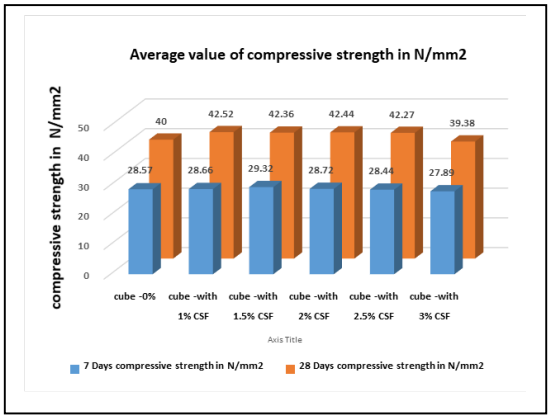

Fig.5. 7days & 28days compressive strength in N/mm^2 Addition of CRF by weight of cement

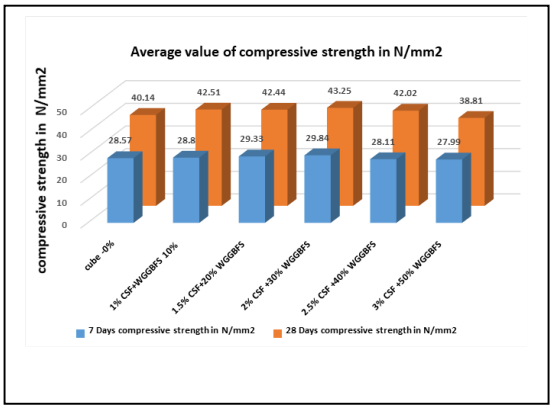

Fig.6. 7days & 28days compressive strength in N/mm^2 Addition of CRF by weight of cement and cement replacement by GGBFS with different percentage

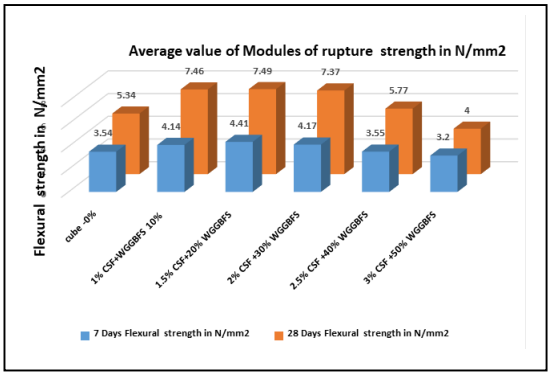

Fig.7. 7days & 28days Flexural strength in N/mm^2 Addition of CRF by weight of cement

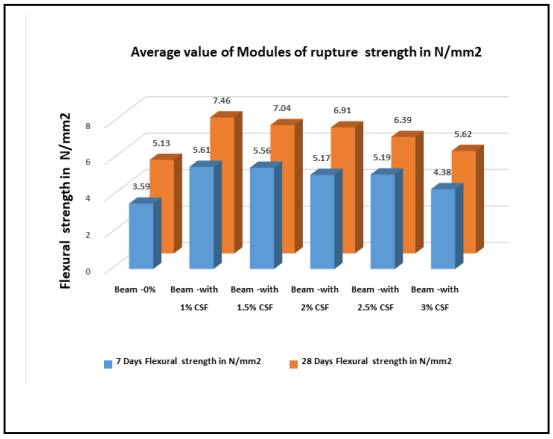

Fig.8. 7days & 28days Flexural strength in N/mm^2 Addition of CRF by weight of cement and cement replacement by GGBFS with different percentage

IV. CONCLUSION

The strength of concrete is determined by using Flexural test and strength test of M40 concrete. Compressive strength, Flexural strength, slum test of concrete mixes made with and without steel fibre, sand and WGGBFS dust have determined at 7 & 28 days. The compressive and flexural strength have determined of 1%, 1.5%, 2%, 2.5%, and 3% steel fibre added M40 concrete. Results shows that the increase SF compressive strength of the cement is high as compare to M40 cement concrete.

Whose gives best result finally we can say that on this percentage will be used in daily routine and practice

On the basis of the results obtained conclusions can be drawn.

- The mixes of the steel fibre percentage have increases with cement resulting in higher compressive strength in the concrete mix. And gives different result but in (1% or 1.5 %) But also see that when we used CSF in concrete or variation of fiber its help for hold compressive strength.
- The results clear indicate the compressive strength of the 28 days' material is higher as compare to 7 days' material. We can say that age of concrete.
- Figure shows that the M40 with mix concrete with 1%, 1.5%, 2%, 2.5%, and 3% steel fibre compressive strength for the 7 & 28 days. The results clear indicate the strength of the Sample-3, 1.5% CSF is higher than other percentage mix CSF. But as increasing fiber we required more compaction in concrete
- Figure shows that the M40 with mix WGGBFS in concrete with 10%, 20%, 30% 40%, and 50% cement replacement compressive strength for the 7 & 28 days. The results clear indicate the strength of the material is decrease with increase in cement percentage in concrete.
- we clear indicated the various percentage of mix in concrete both WGGBFS gives best result on 2% S.F. and 20% WGGBFS as well as we found in case 1.5% of CSF also gives good result
- The flexural strength results clear indicate the strength of the beam1 % CSF is higher than the 2%, 2.5%& 3% mix CSF. To required more compaction required good workmanship.
- The flexural strength is decreases with increases in the %SF in concrete.

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