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Effect of Chopped Glass Fibers on The Strength of Concrete Tiles

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***Abstract*— The comparative study of fibre glass with test of compressive strength, split-tensile strength and flexural strength were performed on M-30 grade cube and tiles specimen concrete as per norms IS 10262. The size of aggregates used was 20mm maximum. To analyze the effect on compressive strength, flexural strength, split-tensile strength 6 cubes, 6 tiles were casted and tested.**

A practical result of glass fiber reinforced concrete in the form of concrete tiles was taken into consideration without any special technique was used to produce these tiles. The tiles thickness was 20mm or size of aggregates used was 6mm is maximum. The proportion of mix used was 1:1.80:2.60 and The ratio of water cement kept consistent and the percentage of admixture was varied from .6 to 1.2 to maintain the slump in between 60mm to 120mm. The fibres size used were 5micron meter to 25 micron meter and the fibres were alkali resistant. The experimental study of the short fibres on, compressive strength wet transverse strength and water absorption was carried out. Six full sized tiles 15cm*15cm*2.5cm were tested and the results recorded.

***Index Terms*— fiber glass tiles, AR, mix proportion**

I. INTRODUCTION

We know basic constituents of building material is concrete because it is comparatively cheap and its ingredients are easily available, and concrete available in wide range of civil construction and infrastructure works. Although concrete have some of demerits as weak in tension, brittleness and lower resistance to crack restoration. For there a behavior of Concrete brittleness and possess low tensile strength but as we add fibres, decrease its brittle behavior and the increases tensile strength. With the respect of time a many specimen are in experiments that have been done to increase the concrete properties in initial fresh state or also in hardened state. The desired properties like workability, Increase or decrease in setting time and higher compressive strength are depend also by super plasticizers, admixtures, micro fillers and basic constituents remain the same .

For structural concretes Fibres, that have classification according to their material as

Alkali resistant Glass fibres (AR), Steel fibres , Synthetic fibres, Carbon, pitch and

polyacrylonitrile (PAN) fibres. A cementitous complex product reinforced with distinct glass fibres of vairable length and size are known as Glass fibre reinforced concrete (GFRC) . This glass fiber mostly use for is alkaline resistant because alkali decreases the

Durability and resistance of GFRC. Basically Glass is made up by silica (SiO_2) ,lime stone ($CaCO_3$) and sodium carbonate (Na_2NO_3).

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II. PRESENT INVESTIGATION

Exploration of the split-tensile strength compressive strength, and flexural strength properties of concrete reinforced with short discrete fibers is The main intention of this research. The study is work out on M-30 grade concrete and the size of glass fibers used is 30mm and the fiber content varied from 0.1% to 1.0% of the total concrete weight. Also In this study of the above three properties no admixture was used. We have studied whose fiber content was varied from 0% to 0.7% of the total weight of concrete and observation of the effect of glass fiber on cement and concrete tiles were utilized. On the terms with heavy duty Cement and concrete tiles are used at major places with practical use.

III. GLASS FIBER REINFORCED CONCRETE

A cementitous complex product reinforced with distinct glass fibres of vairable length and size are known as Glass fibre reinforced concrete (GFRC) . This glass fiber mostly use for is alkaline resistant because alkali decreases the durability and resistance of GFRC. Basically Glass is made up by silica (SiO_2) ,lime stone ($CaCO_3$) and sodium carbonate (Na_2NO_3). Sometimes gypsum is additive and all burnt at 2300 degree centigrade to form a glass. Glass strands are utilized by the most part for veneer plates outside claddings, and different components where their reinforcing impacts are required during construction. Glass fiber is available in various size

shape length and width and there for form GFRC .a glass as a waste that waste use with concrete to form stiff in fresh state has lower slump and hence less workable, hence water reducing admixtures are used. Onwards the properties of GFRC also depends on various parameters like method of producing of product.

It also be done by different methods as casting ,fogging, extrusion etc. but here cement is effective with glass fiber and that's by we need to use fiber ,sand/filler with a cement ratio method and consider also duration of curing also according to the local climatic temperature.

IV. NATURAL FIBRES

Natural fibres were traditionally used in the past as reinforcing materials and their use so far has been traditional far more than technical. They have served useful purposes but the application of natural fibre as a reinforcing material for concrete is a new concept. Improved tensile and bending strength, , greater resistance to cracking and hence improved impact strength and toughness ,greater ductility are some of the properties of natural fibre reinforced concrete. Ramakrishna et al (2002) looked at the hypothetical and exploratory examinations on the compressive quality and elastic modulus of coir and sisal fibre strengthened cements for different volume divisions. It was watched that both the exploratory and analytical values of flexible modulus had indicated 15% error, which can be viewed as relatively little. Rheological properties of coir fiber strengthened cement mortar were done by Ramakrishna and Sundararajan (2002).Flow value, cohesion and angle of internal friction were resolved for three different mix ratios and four different aspect ratios and fibre contents.

In view of the rheological properties of fresh mortar, it was prescribed to use short filaments with low fibre-content for achieving workability and higher fibre content for better cohesiveness in wet state. Composites of blast furnace slag BFS based cement mortar strengthened with vegetable strands were presented by Holmer Savastano Jr et al(1998). Composites were produced through a straightforward and low-vitality expending strategy, including standard vibration and curing in a wet chamber. Eucalyptus pulp, coir fibres and with a mixture of sisal fibre and eucalyptus pulp gave a suitable performance but the performance deteriorated with time.

The natural fibre composites may undergo a decrease in strength and toughness as a result of debilitating of fibres by the combination of alkali attack and mineralisation through the migration of hydrogen products to lumens and spaces. Romildo D. Toledo Filho et al (2003)
reported their study on development of vegetable fibre-mortar composites of improved durability. So a few methodologies were proposed by the authors to enhance the solidness of vegetable fiber-concrete composites.

V. Experimental Setup

A set of test are conducted to get the calibrated result according to these test procedure we have to follow up them and after we get some result that is important to our conclusion.
We have follow up two methods for this experimental study in this we have to use only cubes and tiles sample from the use of M-30 grade. For the casting of cubes we have to use aggregates of size maximum 20mm and for tiles aggregate size is 6mm and we donot use any type of admixture for the preparation of testing samples.

VI. Compressive Strength Test for Fibrous Concrete

Any type of concrete is judge by testing of compressive strength and durability. We know concrete weak in tension but majorly use of concrete to bear compression for this we have to test the compressive strength and rigidity test. Because in case of tiles major of load is comes via compressive strength.by the use of fibres on the compressive strength of concrete 150mm cubes is getting flexural and this way it were cast and tested .meant for our work we have to test the sample for the period of 7days, 15days and 28 days and the distinction was celebrated.

Fibre at ease was wide-ranging from 0% to 0.6% when the minimal maximum size of aggregates was 20mm for cubes and 6mm for tiles and no admixture was used. The water cement ratio was static at 0.45. The workability of the mix was detected to come down but however no extra water was used.

VII. Split Tensile Strength Test for Fibrous Concrete

Concrete may be imperiled to tension in very rare cases and is never considered to resist straight tension bu concrete. However, the load at which furious would occur is significant and needs to be resolute. The tensile strength of concrete as equated to its compressive strength is very small and we get 10-15 % of the compressive strength. There are various factors which effect the tensile strength of concrete as aggregates, age, curing, air-entrainment and method of test etc.
To ways the split tension test a cubes and tiles concrete fiber specimen is loaded along its
length as a result of the loading tensile stresses are developed along the central diameter along the lateral direction. The specimen splits into two when the limiting tensile strength is reached and this value can be calculated from the load.

VIII. Flexural Strength

Tensile strength of concrete is measured by this test . In genral concrete may not be subjected to direct tension but it is subjected to flexure in various cases mostly in beams which is a flexural member. Flexural strength is also mentioned to as modulus of rupture. In order to analyze the flexural strength.

IX. Tests Carried Out on Cement and Concrete Tiles

Cement and concrete carpeting tiles are experienced as per IS 1237: 2012 There are various tests given in the IS code but in that experimental study we only considered the water absorption test and wet transverse strength .Other tests that were conducted on the tiles was the pulse velocity test which is a non-destructive test and predicts the quality but not the grade of concrete. The indian standard code does not conclude about anything about the compressive strength test but however in order to check the compressive strength 6 no. of 100mm cubes were cast and tested at 7 days and 28 days.

X. Water Absorption Test

Six tiles were immersed in water for 24hrs, than the tiles were taken out and wiped dry. Each tile was immediately weighted after saturation. The tiles were then placed in an oven at 65^0C for 24 hrs and then cooled and reweighed at room temperature.

Water absorption was calculated using the formula as given below:

$$\frac{M_1-M_2}{2}$$

Where
M_1= mass of saturated specimen

M_2= mass of oven-dried specimen

XI. Compressive Strength

To get the compressive strength variation due to glass fibres 100mm cubes were cast with the same mix as used for casting concrete tiles with the same amount of admixtures. Six 100mm cubes were cast for each fibre content. Three cubes were tested at 7days and three at 28 days. The compressive test was done on universal testing machine. The cubes were cured using pond curing method and before testing they were allowed to surface dry. The formula used for calculating compressive strength is given below:

$$C = P/A$$

Where,
P=load in Newton (N) at which failure occurs,
A=surface area in mm^2.
Compressive Strength of Concrete (in N/mm^2)

The compressive strength test was considered and the result of 3 samples calculated is shown as below form Table 1 indications the data of 7 days compressive strength gotten. Table 1 states the 7 day compressive strength of concrete is attain with using of maximum nominal size of aggregates 20mm.from this result we are plotted the graph of The 7 days compressive strength Fig1.

Table 1: Compressive strength test (in Mpa) for cube of 7 day

Sr.no	Without fiber	0.3% of fiber
1	15.15033	19.9313
2	14.7467	20.33499
3	14.76	20.7297

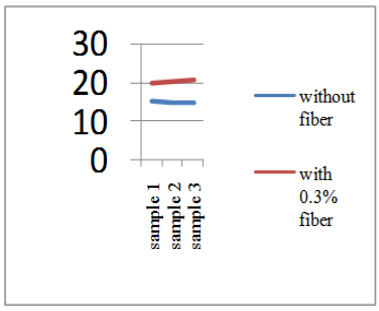

Fig. 1 Test on sand

Specific gravity test: material specific gravity test is done using a pycnometer by the procedure confirming to IS 2386 part iii-1963.The specific gravity was calculated to be 2.66 Sieve analysis of sand : In order to ascertain the particle sine distribution of sand Dry sieve analysis was carried out. The sieve sizes were as per IS 2386-part I. The zone of sand was zone iii

XII. Methodology

Waste glass is show pozzolanic behavior under 100um.
The smaller particles size of glass powder has higher activity with lime resulting in higher compressive strength in the concrete mix.
Compared to fly ash concrete, finer glass powder. Concrete had slightly higher early strength as well as late strength
Micro structure examination shows that glass powder produces a densor matrix which improves durability property of concrete.
The coff. Of capillary absorption test also indicates that incorporation of timer glass powder improve durability.
The result obtained from the present study shows that, there is great potential for the utilization of best glass powder in concrete as replacement of cement and fond.

XIII. Procedure of Experimental Study

According to the IS code norms we have to perform primary test as there are some of tested majorly and some of tested are mannerly. Combinations are prepared by use of raw material as cement, fiber and sand such are ingredients tested primarily to their standards to perform major test. Somewhat like Tests of corporal things of sand, cement and fiber were directed first and after that use in research and development.

Specific gravity test for cement: according to the norms of IS code we know the sp. Gr. Of cement is 3.11. Consistency Test for cement: According to directed principal of IS 4031-part (4) 1988 an experimental setup of this test is Vicat's apparatus and this gives the regular uniformity is 28%-32%.
Fineness test for cement: from the using of methodology of sieve analysis according to IS 4031-part 1 fineness of cement is calibrated by the technique of sieve analysis. For this approach we have taken almost 10g specimen sample of cement was distressed for 2 mins over a 90 micron sieve. final result of this test we have to get any retained weight or dust from this sieve

XIV. Preparation of M-30 Grade of Fibrous Concrete

M-30 grade of concrete was ready by use of the guideline of the indian standard code provision without using of admixture there for we take the maximum water cement ratio is 0.45. for this ratio workability of concrete fiber mixture is at great extent. We use here 0.1% to 0.6% according to the work demand. On the other hand after the prepare of mixture we need to settle down to reduce its voids by help of plate vibration and the mixture is surfaced smooth by hand trowel this way we can prepare fibrous concrete raw material

XV. Modelling Approach

Mechanical characterization and impact behaviour of concrete reinforced with natural fibres were studied by Al-Oraimi and Seibi (1995). Here, an exploratory study was led utilizing palm tree and glass filaments on high quality cement. Mechanical quality properties, for example, compressive strength, part ductile, flexural qualities and post breaking toughness were concentrated on. It was reasoned that common strands will be similar with glass filaments. A limited component examination was additionally done utilizing ANSYS programming.
The expository and test results were analysed and adequate. Antonia F. Barbosa and Gabriel O. Ribeiro (1998) worked on ANSYS for limited component investigation of reinforced solid structures. An essentially upheld fortified concrete bar subjected to consistently conveyed burden was taken as a basic sample in that study Two different models were considered for steel reinforcement such as discrete and smeared. Load –deflection curves obtained through ANSYS have been compared with experimental results and they have been found to be satisfactory.

Finite element analysis using ANSYS was done by Greeshma and Jaya (2007) to analyse a shear wall under seismic loading. Modelling of shear 21 wall was done using SOLID 65 model and reinforcements were modeled using LINK 8 element. The analyses were carried out for the shear wall, subjected to both static and dynamic loading.

XVI. Analytical Approach

One of the important applications of fibre reinforced concrete involves making earthquake resistant structures. Not only earthquakes, most of the unanticipated loadings are cyclic in nature. The behaviour of fibre reinforced concrete beams under cyclic loading which simulates seismic motion is important from study point. The critical seismic design parameter called cumulative ductility Indicator was proposed by Banon et al (1981).

Roufail and Meyer (1987) proposed some analytical modelling of hysteretic behaviour of reinforced concrete structures. Measures of stiffness degradation have been considered as damage indicators But in the equation used, the effect of repeated cyclic loading was not considered.

Kratzigetal (1989) proposed a model to evaluate the damage index in reinforced concrete under cyclic loading. The proposed damage index was based on the hysteric energy absorbed by a member. The first loading cycle at given amplitude is termed as primary half cycle, with
subsequent cycle at the same or smaller amplitudes termed as follows. Then, the damage index for the positive half cycle was defined. A similar index was defined for a negative cycle, the overall damage index was calculated

XVII. CONCLUSIONS

The conclusion of this experimental study shows the outcome of short discrete glass fibers on the split tensile strength ,compressive and flexural strength of concrete as.

The consequences on the glass fibres by cement and concrete tiles that are mounted by vibration technique are also deliberate. The stuffs studied are compressive strength and water absorption .when we increase the quantity of the glass fiber The concrete mix gets tougher and not as much of workable. Hence we are deliberated 0.1 to 0.6% variation are numerated their result.
The numerous analysis and tested data shows some values are as follows:

1. In the result of compressive strength of concrete deprived of admixture is not unnatural by the presence of short discrete glass fibers with fibre content in the range 0.0 to 0.6 % of fiber content by weight of concrete.
2. Increase in glass fibers increases The split tensile strength of concrete
3. Increase in the fiber content The flexural strength of concrete and by this tension carrying capability of concrete may escalation in flexure.
4. The water absorption of the concrete decreases by the increase in fiber content.
5. comparatively tiles of fiber glass is more economical and durable over all.

Cost material	unit price	
white cement	11.50 per kg.	
silica sand	rs 3.00 per kg	
glass waste	rs 260 per kg	
blasticizer	rs 95 per kg	
s. b. r. Rubber	rs 160 per kg	
Material strength	7 days (n/mm2)	28 days (n/mm2)
normal concrete	15.15033	22.72
glass mixed concrete	19.9313	27.50
fly ash cup	6.66	20.32

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