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Study About Mechanical Properties Of Fiber Reinforced Concrete

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Abstract - In this paper is presented based on the excellent properties of light guiding and elasto-optic effect of optical fiber, a novel smart transparent concrete is researched by arranging the optical fibers into the concrete. The main purpose was to use sunlight as a light source in order to reduce the power consumption of illumination.Optical fibres are one which helps for transmission of light through the concrete The present investigation aims at producing the concrete specimens by reinforcing optical fibers with different percentage and comparing it with the normal concrete. Different tests were carried out on the concrete specimens like compressive strength test, flexural strength, light transmission test etc. The compressive strength results obtained for the specimens with optical fibers was almost same as that of normal concrete specimen.

Keywords: optical fiber, illumination, LiTraCon, compressive strength, flexural strength

I. INTRODUCTION

Concrete is a major building material which has been used in construction industry throughout the world. It is a widely used construction material for various types of structures due to its structural strength and stability. Concrete is a composite construction material composed mainly of cement, aggregate and water.Fiber reinforced concrete is recently developed, if the optical fiber is embedded in concrete it is called as the LiTraCon{light transmitting concrete}or transparent concrete. This concrete was developed in 2001 by Hungarian architect Aron Losonczi. Light transmitting concrete block was successfully produced by using large amount of glass optical fiber into concrete in 2003 it was the light transmitting concrete. Light transmitting concrete is one of the fibre reinforced concrete which is used for good aesthetic appearance.

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II. MATERIALS AND METHODS:

A. Cement:

The most common cement used is an ordinary Portland cement. The Ordinary Portland Cement of 53 grades conforming to IS: 12269-1987 is being used. Many tests were conducted on cement;

specific gravity = 3.1
consistency tests = 26%
initial setting time = 35
fineness of cement = 98%
specific gravity of cement = 3.1

B. Aggregate:

Aggregates are the important constituents in concrete.

1) Coarse aggregate:

The fractions from 20 mm to 4.75 mm are used as coarse aggregate. The Coarse Aggregates from crushed Basalt rock, conforming to IS: 383-1970 are being used

Specific Gravity = 2.74
Fineness modulus = 3.82%
Water absorption = 4.35
Impact value, = 13.3%

bulk density were carried out for coarse aggregate as per IS -2386 (I, II & IV) 1963.

2) Fine aggregate:

The fractions from 4.75 mm to 150 micron are termed as fine aggregate. The river sand and crushed sand is being used in combination as fine aggregate conforming to the requirements of IS: 383-1970.

The Specific Gravity = 2.8
Fineness modulus = 2.34%
Water absorption = 1.0 percent

Unit weight and Bulk density of the fine aggregate were tested as per IS 2386 (Part III) - 1963

C. Water:

Water is an important ingredient of concrete as it actually participates in the chemical reaction with cement It is conforming to the requirement of IS 456-2000 was used for mixing concrete and curing the specimens.

D. Optical fiber:

Drawing glass (silica) or plastic to a diameter slightly thicker than that of a human hair. The optical fibers used in

communications have a concrete structure one end to another end. They consist of two sections: the glass core and the cladding layer . The core is a circular cylindrical structure. This second layer is referred to as a plastic coating.

E. Types of optical fiber

There are three basic types of optical fibers:

1. Multimode graded-index fiber
2. Multimode step-index fiber
3. Single-mode step-index fibers.

F. Properties of opticalfiber

- ❖ Resistance to compression that varies from 150 mpa up to 250 mpa
- ❖ Maximum water absorption of 0.35%.
- ❖ Maximum oxygen index of 25%.
- ❖ Thermal conductivity of 0.21 w/m °c.
- ❖ Elastic limit greater than 60 mpa.
- ❖ Young's modulus from 2750 mpa to 3450 mpa
- ❖ Density 2100-2400 kg/m2

III. EXPERIMENTAL INVESTIGATION

A. Mix design of concrete specimen:

M20 grade of Concrete was designed as per IS 10262:2009 and the mixing ratio of concrete is 1:1.608:2.56(cement: fine aggregate: Coarse Aggregate). A water cement ratio of 0.45 was adopted.

TABLE: 1 - MIX RATIO

Water(lit`)	Cement(Kg/cu.m)	Fine aggregate (Kg/cu.m)	Coarse aggregate(Kg/ cu.m)
197	437.8	704.36	1124.6
0.45	1	1.608	2.56

IV. EXPERIMENTAL INVESTIGATION:

The conventional concrete and the fiber added concrete carried out the test on prepare the concrete specimen cubes and prisms and cylinder at 28 days of concrete.

A. Workability:

The slump values for conventional and fiber added concrete mix are carried out in a standard slump apparatus. The value of the slumpcone test 100% of slump value.

B. Compressive strength of cube:

The standard size of moulds 150*150*150 mm are thoroughly fitted and cleaned and then oil was applied. Then casting of concrete and de-moulding then curing process was done as per the procedure. After 28 days of curing process the specimen was tested in a compressive testing machine. The compressive strength of concrete with different fibre ratios such as 5% was determine 7 and 14 and 28 daysof concrete.

Compressive strength = load/area

C. Flexural strength of prism:

The standard size of moulds 500*100*100 mm are prepared. The prism is tested in universal testing machine. The flexural strength of concrete with different fibre ratios such as 5% was determine on 7and 14 and 28 days of concrete.

Flexural strength = Pl/bd2

Where,

P – Load, l – Length of the specimen, b - width of the prism, d – depth of the prism

D. Light observing test:

Light transmitting test was tested the small circular cylinder at size of cylinder 105*50 mm

E. Procedure of making translucent concrete

- ❖ preparation of fiber placing Mould
- ❖ Placing the Fibres
- ❖ laying the Concrete
- ❖ Breaking the Mould
- ❖ observing the light

Step 1- preparation of fiber placing Mould

Make the plastic cylindrical mould of size will be (105*50)mm

Step 2- Placing the Fibers

Fiber are placed individually in mould of concrete

Step 3- laying the Concrete

filling the concrete carefully and slowly in fiber placed mould

Step 4- Breaking the Mould

Once the concrete is curing for 24 hours, pull off the red soil and cut off the plastic ring.

Step 5- observing the light

Cut to the extra longfibers. And observed the transmitting light.

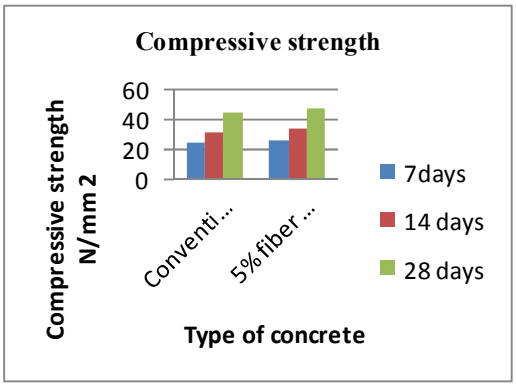
V.RESULTS AND DISCUSSION:

A. Comparison of Compressive Strength of Cube

Compressive strength concrete tested on using compressive testing machine. The compressive strength of different between fibre added concrete and conventional concrete. Eighteen concrete cubes (150x150x150mm) were casted and tested in compression (ASTM C39) at the end of7and14 and 28 days.

TABLE: 2 - COMPARISON OF COMPRESSIVE STRENGTH OF CUBE

Type of concrete	Compressive strength Of Cube specimen N/mm 2		
	7 days	14 days	28 days
Conventional concrete	23.991	31.289	43.452
5% fiber added concrete	25.276	33.756	46.208

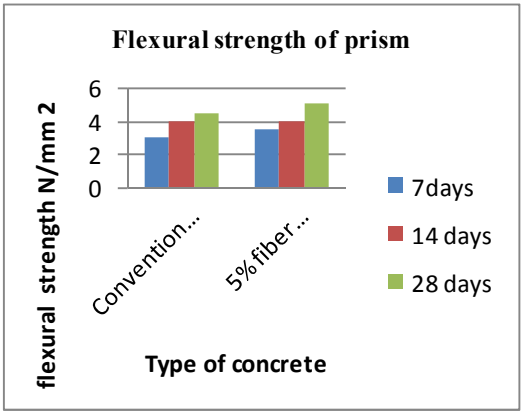


B. Flexural strength of prism:

The flexural strength of concrete tested on by using UTM (universal testing machine).if the flexural strength concrete are compared with conventional concrete and fiber added concrete. Eighteen concrete prism (500x100x100mm) were tested in flexure (ASTM C7875) after 7 and 14 and 28 days.

TABLE: 3 - COMPARISON OF FLEXURAL STRENGTH OF CUBE

Type of concrete	Flexural strength Of Cube specimen N/mm 2		
	7 days	14 days	28 days
Conventional concrete	3	4	4.5
5% fiber added concrete	3.5	4	5



VI. CONCLUSION

- The compressive strength of fibre added concrete was increased compared to
- conventional concrete.
- The flexural strength of fibre added concrete was same as the conventional concrete.

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