iJRASET
International Journal For Research in Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 5 **Issue:** X **Month of publication:** October 2017

DOI: http://doi.org/10.22214/ijraset.2017.10256

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor:6.887
Volume 5 Issue X, October 2017- Available at www.ijraset.com

Experimental Study on Transparent Concrete

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Abstract: With the world looking towards more beautiful, better, strong energy saving, building material for the good future. Engineers are all over the world are experimenting with different construction materials. In this project represents transparent concrete as the smart building material with increased strength good aesthetic appearance and also having the light transmitting property. Saving of energy and safety evaluation are the two important key issues for the buildings or infrastructure. in this case, the concrete specimen is produced by embedding the optical plastic fibres with different percentages and comparing it into the conventional concrete. Difference tests were carried out in the specimens like compressive strength, split tensile strength and intensity of the light passing through it. The results of the experiments shows that an optical plastic fibre can be easily blended with the concrete and it can also provide a steady light transmitting ability. The compressive strength test obtained for the specimen having high optical plastic fibre was found to be the higher strength as compared to the conventional concrete. which clearly indicates that the light transmitting concrete allows the light through it without affecting the strength of the concrete.
Keywords: Optical Plastic Fibres, Transparent Concrete, Compressive Strength, Split Strength Test

I. INTRODUCTION

Conservation of energy has become an important issue in today's world. One research estimated that by 2050, the carbon is released by institutional, commercial and residential buildings that will amount to 3800 tonnes and this carbon will consume 38% of the global energy. In order to reduce the energy consumption by structures and also the upcoming building construction in future.Many researchers and scientists were attracted towards the development of new construction material which will consume very less amount of energy. Transparent concrete is the concrete is one such new developed material. Concrete is the basic thing or material required for all types of construction. This type of transparent concrete is an innovative concrete it has the ability to letting light pass through it.This innovative concrete is made transparent by reinforcing the optical plastic fibres in it. This is because of optical plastic fibres can transmit sunlight without any light, heat or any other photochemical reaction. In this optical plastic fiber can transmit the light from one end of the fibre to another. Hungarian architect AronLosonzi was the first person who forward the concept of transparent concrete in 2001. The first transparent concrete block was named as LiTraCon in 2003. The main purpose is to use sunlight as a light source in order to reduce the power consumption. In this study, the results of including optical plastic fibres on compressive strength and split tensile strength of the concrete has been studied. The optical plastic fibres were added in to the concrete layer by layer distributed uniformly throughout the body of the concrete block. The compressive strength of the transparent concrete is also compared with that of the conventional concrete block. It gives the result that the compressive strength of the transparent concrete is more than that of the conventional concrete.

II. MATERIALS

A. Cement: Ordinary Portland cement, 53 grade confirming to Is1269-1987.

B. Fine aggregate : Locally available river sand confirming to grading zone II of nominal size 1.18 mm as per IS:383-1970.

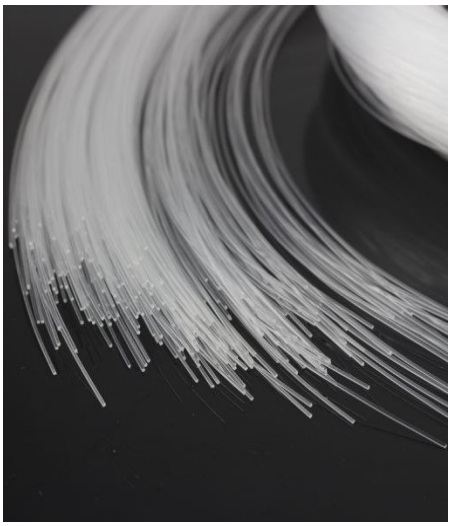
C. Coarse aggregate : Locally available crushed blue granite stones confirming to graded aggregate of nominal size 10 mm as per IS :383 -1970.

D. Water : Portable water

E. Optical fibre : Plastic optical fibre

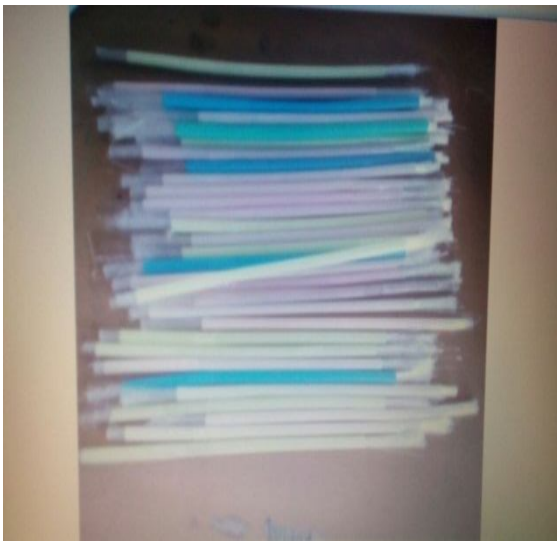
Optical fibre is a flexible transparent fibre made by drawing glass or platic to a diameter slightly thicker than that of human hair. Optical fibre are used most often as a means to transmit light between the two ends of fibre and light find wide usage in fibre optic communication. The diameter of optical plastic fibre was 1mm.

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III. EXPERIMENTAL PROGRAM

Seven cubes of size 15cmx15cmx15cm were made. One of the cube used for as the conventional concrete and others are used for transparent concrete. The optical plastic fibres are adding with different percentage in the concrete specimens like cubes and cylinders. The optical fibres in transparent concrete were distributed in horizontal direction equally at a distance of 2.5cm. they constituted as 0.2%, 0.4% and 0.6% of total volume of the concrete cubes and cylinders.For transparent concrete Cube, wooden mould of size 15cmx15cmx15cm were prepared each cubes contains the holes for taking the optical fibres in horizontal direction. For transparent concrete Cylinder, pipe mould of size 150x300mm were prepared, each cylinder contains the holes for taking the optical fibres in horizontal direction. And these holes in the cubes and cylinders are filled by optical fibres with 0.2%, 0.4% & 0.6%respectively. Before filling these cubes and cylinders with concrete they were coated with oil, so that, the concrete cubes and cylinders would not adhere to the moulds. The compressive strength of the cubes and split tensile strength of the cylinder was found out using Univesal Testing Machine.



Fibres were inserted in the straws

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A. Mould Preparation



Cylindrical Mould

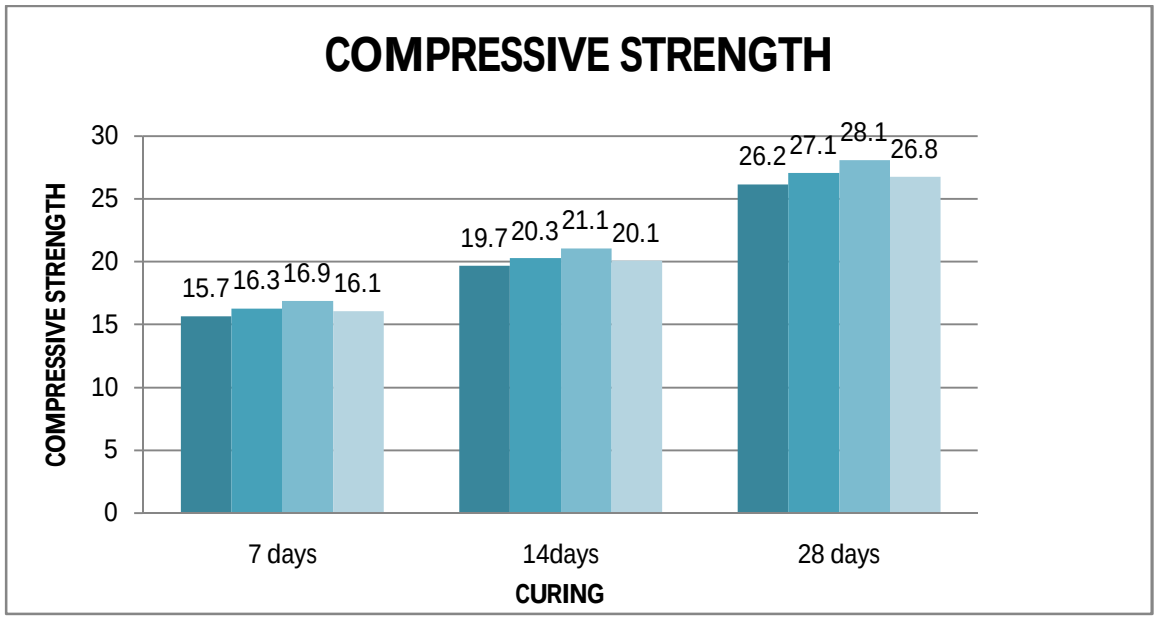


Cubical Mould

IV. RESULTS AND FINDINGS

Compressive Strength Test On Cube For 7, 14 And 28 Days

MIX	MIX %	COMPRESSIVE STRENGTH		
		7 days (N/mm^2)	14 days (N/mm^2)	28 days (N/mm^2)
M1	0	15.72	19.65	26.2
M2	0.2	16.26	20.33	27.1
M3	0.4	16.86	21.08	28.1
M4	0.6	16.08	20.10	26.8

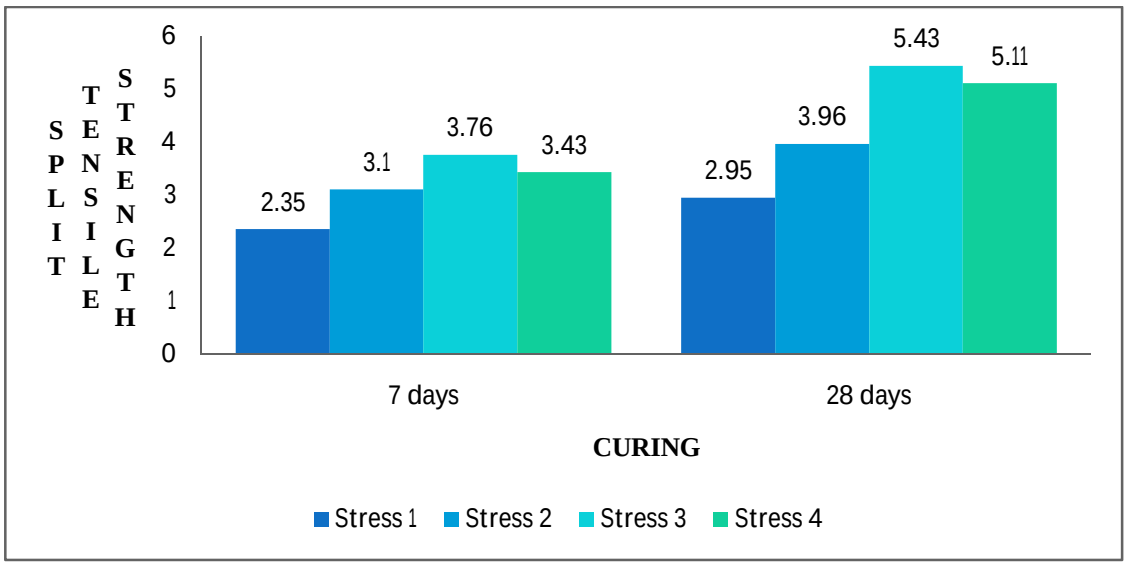


The results of compressive strength were presented in the table and graph. The cubes were tested using Universal Testing Machine (UTM) and Compression Testing Machine (CTM). The Compressive strength of 7, 14 and 28 days were obtained. From the table the maximum compressive strength obtained is 0.4% addition of Optical plastic fibre to the Concrete cube.

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A. Split Tensile Strength

MIX	MIX%	SPLIT TENSLIE STRENGTH	
		7 Days (N/mm^2)	28 Days (N/mm^2)
M1	0	2.35	2.95
M2	0.2	3.10	3.96
M3	0.4	3.76	5.43
M4	0.6	3.43	5.11



The results of Split Tensile Strength were presented in the table and graph. The cylinders were tested using Universal Testing Machine (UTM). The Split Tensile Strength of 7 and 28 days were obtained. From the table the maximum Split Tensile Strength obtained is 0.4% addition of Optical plastic fibre to the Concrete Cylinder.

V. CONCLUSION

A. All the experimental data shows that the addition of optical fibre improves the hardened properties. This study showed that the transparent concrete can reduce electricity bills without compromising with the strength of the buildings. It has been shown that:

B. The efficiency of the application of optical fibre is studied by comparing the strength with the nominal M25 grade concrete and the test results proved that the is more in all aspect.

C. The ideal percentage of adding optical fibre is 0.4%.

D. There is a gradual increase in the compressive strength of the concrete by increasing the optical fibre upto 0.4% and on further addition of the optical fibre decreases the strength parameters.

E. Compressive strength of the concrete is higher in the optical fibre parallel to the load applied than the optical fibre perpendicular to the load applied.

F. Thus, the reinforcing of the optical fibre will transmit light and also eventually increases the strength of the concrete.

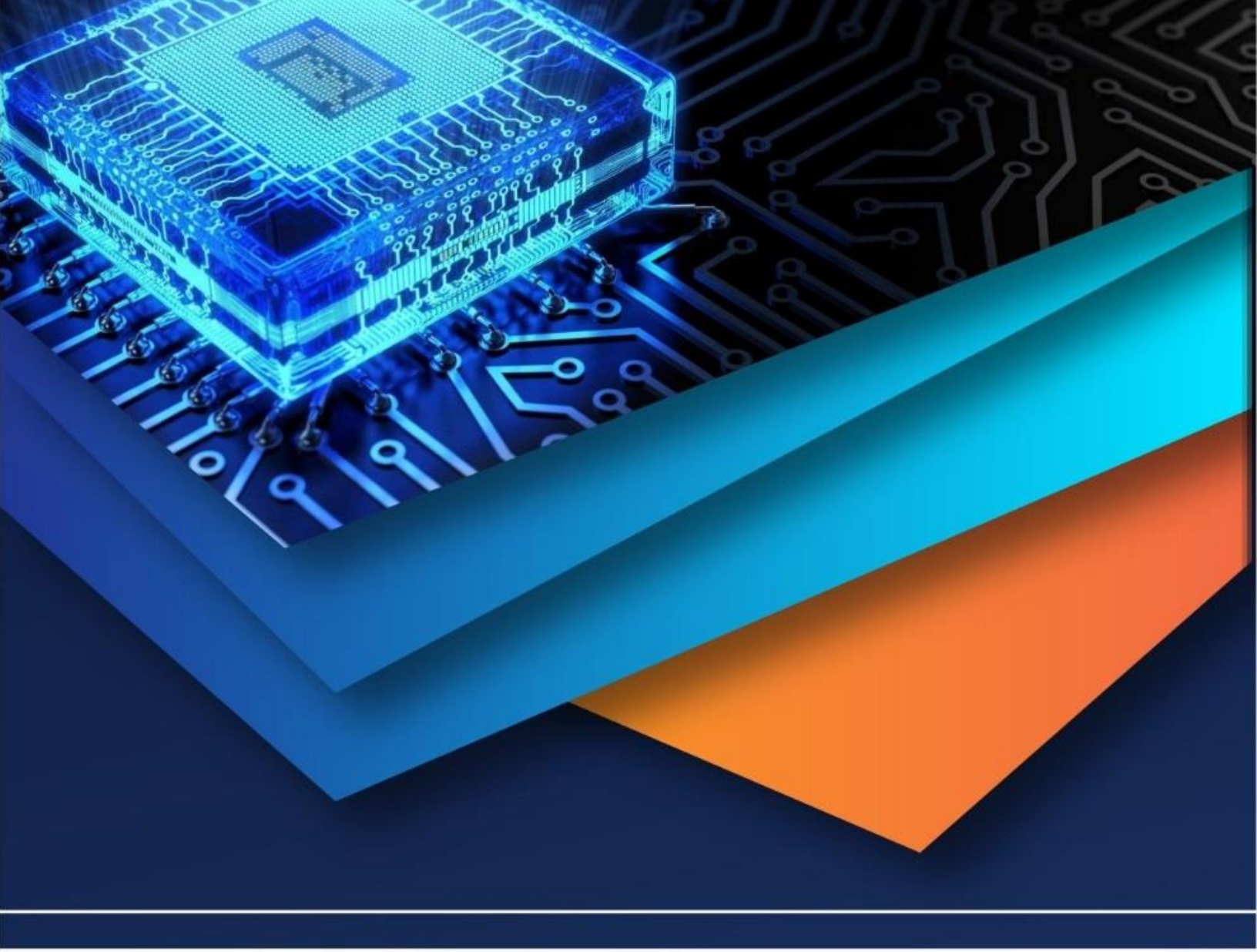
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