EXPERIMENTAL INVESTIGATION ON TRANSLUCENT CONCRETE

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Abstract - *Concrete structural components exist in buildings in different forms and shapes. This concrete plays vital role in construction industry and at present scenario it is important produce concrete structures without affecting the environment. So, to produce sustainable concrete a new development is necessary to deal with. Therefore Light transmitting concrete is one option that utilize the natural light source effectively and at the same time satisfying the strength and aesthetic needs. This project deals with producing light transmitting blocks using the plastic optic fiber (POF) in cement mortar and concrete. Here the Plastic optical fibers are embedded in the concrete to transmit the light effectively. Fibers (by weight) are sandwiched between each layer of mortar and concrete and comparative study carryout on compressive strength of the normal concrete and concrete with addition of POF in different percentage. The result indicates that, compressive strength of light transmitting concrete is equal to the normal concrete strength. Light transmittance through these concrete are found by measuring the current corresponding to the light which can be measured by Light Dependent Resistor (LDR). Light transmittance ability for the cement mortar blocks samples found to be 5 to 10% in and 3 to 6% in concrete blocks. The result indicates that cement mortar blocks have high transparency than concrete blocks.*

Key Words: **Light transmitting concrete, plastic optic fiber, high transparency**

1. INTRODUCTION

Economic development of the country is based on civil engineering structures. In developing countries conservation of energy is an important issue. The construction of the structures mainly deals with concrete. Basically concrete does not have any light transmitting property. In later, the concept of translucent concrete was first introduced by HUNGARIAN ARCHITECT ARON LOSONZI. In 2003, the first translucent concrete produced by mixing large amount of glass fiber into concrete. It can be produced as prefabricated building blocks and panel. Due to small size of the fiber, they blended into concrete becoming a component of the material like small piece of aggregates because of parallel position of the fiber. The light information on the brighter side of the wall appears unchanged on the darker side. Casting of the concrete aims to reducing the electrical energy by placing the optical fiber into the concrete.

1.1 OPTIC FIBER

Optic fiber is a flexible, transparent fiber made by clear casting resin. It consist of core and cladding. The core is the part where total internal reflection takes place, where as the cladding acts as protective layer for the core in order to avoid scattering of light. These are used most often as a means to transmit light between the two ends of the fiber. In day-to-day life optic fiber are mainly used in communication purpose because of its rapid transmitting ability. Now a days these optic fiber are introduced in construction field too. In order to reduce the optic fiber cost we have introduced clear casting resin for the production of fiber.

1.2 PRINCIPLE OF OPTIC FIBRE OPERATION

An optical fiber is a cylindrical dielectric wave guide (non conducting waveguide) that transmits light along its axis, by the process of total internal reflection. The fiber consist of a core surrounding by a cladding layer both of which are made of dielectric materials. To confine the optical signal in the core the refractive index of the core must be greater than that of cladding. The boundary between the core and the cladding may neither be abrupt, in step index fiber or gradual, in graded-index fiber.

2. EXPERIMENTAL PROGRAM

2.1CASTING OF SPECIMEN

Making of optic fiber

Placing of plastic optical fiber

Mixing of concrete

Pouring of concrete

Compaction of concrete

Demoulding and curing

Cutting and Polishing Of Cubes

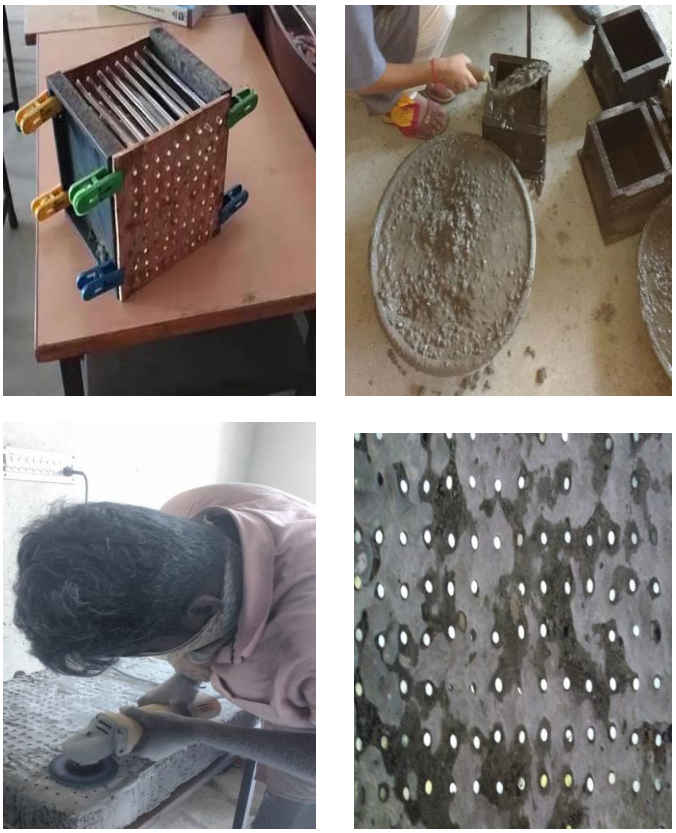

Fig -1: Casting of specimen

2.2 TESTING OF SPECIMEN

Calculate the material required for preparing the concrete of given proportions. Mix them thoroughly in mechanical mixer until uniform colour of concrete is obtained. Pour concrete in the oiled with a medium viscosity oil. Fill concrete is cube moulds in two layers each of approximately 75 mm and ramming each layer with 35 blows evenly distributed over the surface of layer. Fill the moulds in 2 layers each of approximately 50 mm deep and ramming each layer heavily. Struck off concrete flush with the top of the moulds. Immediately after being made, they should be covered with wet mats. Specimens are removed from the moulds after 24 hrs and cured in water for 28 days. After 24 hrs of casting, cylinder specimens are capped by neat cement paste 35 percent water content on capping apparatus. After 24 hrs the specimens are immersed in to the water for final curing. Compression tests of cube, cylinder and beam specimens are made as soon as practicable after removal from curing pit. Test – specimen during the period of their removal from the curing pit and till testing, are kept moist by a wet blanket covering and tested in a moist condition. Place the specimen centrally on the location marks of the compression testing machine and load is applied continuously as shown in fig 2 uniformly and without shock. Also note the type of failure and appearance cracks.

Fig -2: Testing of specimen

DAYS	LOAD ($\times 10^3$)N		COMPRESSIVE STRENGTH N/mm²		AVERAGE STRENGTH N/mm²	
	NORMAL	WITH FIBRE	NORMAL	WITH FIBRE	NORMAL	WITH FIBRE
7	425	400	18.9	17.8	22.2	20.1
	525	425	23.3	18.9		
	550	520	24.4	23.6		
14	575	565	25.6	25.1	28.4	23.4
	665	520	29.6	23.1		
	675	495	30	22		
28	755	700	33.6	31.1	34.2	32.7
	750	725	33.3	32.2		
	800	780	35.6	34.7		

Table -1: Compressive strength of cubes

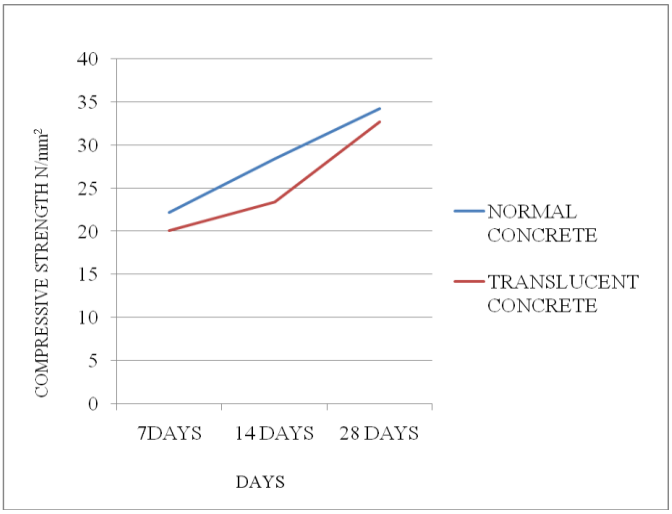

Chart -1: Compressive Strength of Concrete

2.3 POWER TRANSFER TEST

The measurement in fiber optic refers to optical power measured in dB. The difference between the powers coupled in to a fiber optic, a connector and the power that is transmitted through it. This difference in power level before and after the component is what we call optical loss Power in a optic system is like voltage in an electrical circuit .Measuring power requires only a power meter, a known good fiber optic cable and a little help from the network electronics to turn on the transmitter. While measuring power, the meter must be set to the proper range and proper wavelength, matching the source being used in the system (750, 850, 650nm) To measure the power, attach the meter to the cable attached to the source that has the output you want to measure and receiver power measured by receiver. Turn on the transmitter and give it a few minutes to stabilize. Set the power meter for the matching wavelength and note the power the meter measures. Compare it to the specified power for the system and make sure it's enough power but not too much.

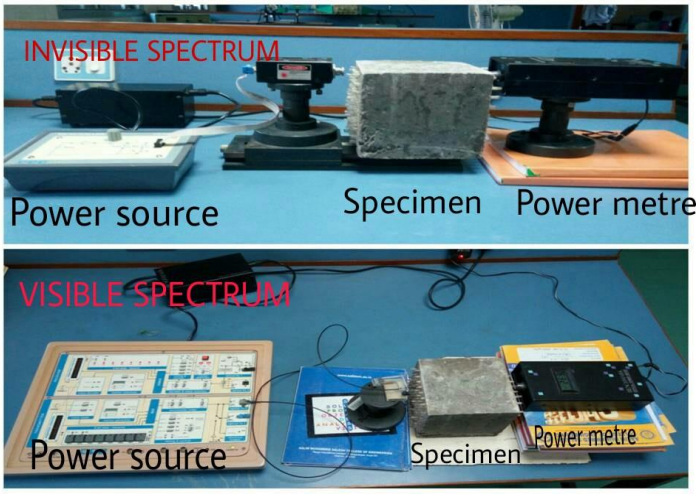

Fig -3: Power Transfer test

INPUT	COMPARISION OF OPTIC FIBRE OUTPUT (dbm)	
	Fibre 1	fibre 2
Fiber optic power Source	-15	-25
	-16	-25.6
	-17	-24.2
	-18	-25.1

Chart -2: Intensity loss by visible spectrum

3. CONCLUSIONS

We have concluded that the compressive strength of M25 grade concrete compared with the both normal concrete as well as fibre concrete tends to be more or less same. Further we conducted the power transfer test on optic fibre to find the intensity loss. The test were done on three sources namely invisible spectrum (880nm), visible spectrum (650nm), and laser (770nm). By comparing it with normal fibre and plastic optic fibre, the intensity loss of fibre is less. In economic point of view the cost of the optic fibre is high. So we replaced with the optic fibre made by clear casting resin which is economically feasible

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