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EXPERIMENTAL STUDY OF TRANSLUCENT CONCRETE ON COMPRESSIVE STRENGTH

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Abstract— **Transparent concrete is a concrete based building material with light-Transmissive properties due to embedded light optical elements usually Optical fibers. Light is conducted through the stone from one end to the other. Therefore the fibers have to go through the whole object. Transparent concrete is also known as the translucent concrete and light transmitting concrete because of its properties. It is used in fine architecture as a facade material and for cladding of interior walls. In this paper, to integrate the merits of concrete and optical fiber, for developing transparent concrete by arranging the high numerical aperture Plastic Optical Fibers (POF) or big diameter glass optical fiber into concrete. The main purpose is to use sunlight as a light source to reduce the power consumption of illumination and to use the optical fiber to sense the stress of structures and also use this concrete as an architectural purpose for good aesthetical view of the building.**

***Index Terms*_cement , sand, aggregates, optical fibers.**

I. INTRODUCTION

In today's developed world energy consumption is very high. Translucent concrete comes in as a blessing solution for easier day lighting. Translucent concrete aims at reducing the operating energy by exploiting vast amount of energy in the form of sunlight. Translucent concrete is a concrete based building material having light transmissive property. Light transmissive property is mainly due to uniform distribution of high numerical optical fibers throughout its body. In 2001, the concept of transparent concrete was first put forward by Hungarian architect AronLosonzi, and the first transparent concrete block was successfully produced by mixing large amount of glass fiber into concrete in 2003, named as LiTraCon. Joel S. and Sergio O.G. developed a transparent concrete material, which can allow 80% light through and only 30% of weight of common concrete.

II. MATERIAL

An OPTICAL FIBER is a flexible, transparent fiber made of glass (silica) or plastic, slightly thicker than a human hair. It functions as a waveguide or light pipe, to transmit light between the two ends of the fiber. The field of applied science and engineering concerned with the design and application of optical fibres is known as fiber optics. Optical fibres are widely used in fiber-optic communications, which permits transmission over longer distances and at higher bandwidths .Fibres are used for illumination, and are wrapped in bundles so that they may be used to carry images, thus allowing viewing in confined spaces. Specially designed fibres are used for a variety of other applications, including sensors and fiber lasers. Optical fibers typically include a transparent core surrounded by a transparent cladding material with a lower index of refraction. Light is kept in the core by total internal reflection. This causes the fiber to act as a waveguide.

Fibres that support many propagation paths or transverse modes are called multi-mode fibres (MMF), while those that only support a single mode are called single-mode fibres (SMF). Multi-mode fibres generally have a wider core diameter, and are used for short-distance communication links and for applications where high power must be transmitted.

Optical fiber is a transparent and flexible material made of silica. This optical fiber helps to transmit light in the cube from one end to other end. The percentage of optical fiber used for the study is 2% by volume.

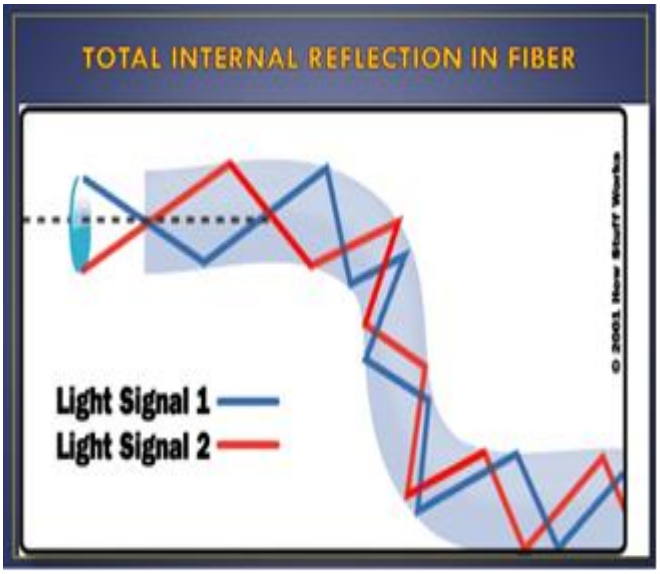

Fig 2.1 Total internal reflection in fibers

A. Material Specification of Concrete*:*

Sl. No	Material	Specification
1	Cement	43 Grade
2	Coarse aggregate	Less than 10mm
3	Fine aggregate	Passing through 2.36mm sieve
4	Concrete	M 25 Grade
5	Optical fiber	1% - 5%
6	Specific gravity of coarse aggregate	2.74
7	Specific gravity of fine aggregate	2.65

III. OBJECTIVES

- To cast a special type of concrete with light transmitting properties.
- To study their characteristics and to develop a functioning material which is not only energy saving but gives out artistic finish.
- Effect of addition of different percentage of optical fibers on the compressive strength of concrete.

IV. METHODOLOGY

- Mould is prepared of size 150 × 150 × 150 mm cube.
- The mould is made up of two plywood faces with a plywood base plate. The two faces of plywood are drilled at a uniform spacing to hold the optical fiber in place during casting concrete into the mould.
- The two drilled plywood faces are placed opposite to each other so as to place optical fiber in a single direction.
- The optical fiber are cut into sufficient length and placed individually through the holes in the two plywood sides facing opposite to each other. Now the concrete is prepared and poured into the mould.
- The mould is compacted to avoid improper filling and void formation. The specimen is then allowed to harden for 24 hours and then the mould is removed and the specimen is kept for curing.
- Mix Ratio Of Concrete – 1 : 2.24 : 1.78.

Fig 4.1 Empty wooden mould

IV. RESULTS

Days/ Percentage	Load in N/mm^2 (0%)	Load in N/mm^2 (1%)	Load in N/mm^2 (3%)	Load in N/mm^2 (5%)
7Days	30.53	28.12	23.55	19.34
28Days	43.55	40.20	36.67	31.10

Table 5.1 Compressive strength of cubes of different percentage

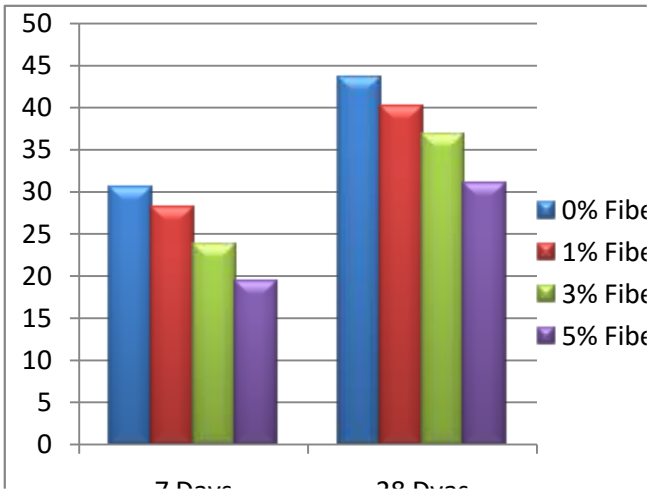

Fig 5.2 Compressive strength comparison of cubes of different percentage

VI. ADVANTAGES AND DISADVANTAGES OF OPTICAL FIBERS

1) The main advantage of these products is that on large scale objects the texture is still visible - while the texture of finer translucent concrete becomes indistinct at distance.

2) When a solid wall is imbued with the ability to transmit light, it means that a home can use fewer lights in their house during daylight hours.
3) It has very good architectural properties for giving good aesthetical view to the building.
4) Where light is not able to come properly at that place transparent concrete can be used.
5) Energy saving can be done by utilization of transparent concrete in building.
6) Totally environment friendly because of its light transmitting characteristics, so energy consumption can be reduced.
7) The main disadvantage is these concrete is very costly because of the optical fibers.
8) Casting of transparent concrete block is difficult for the labour so special skilled person is required.

CONCLUSIONS

- The fibers can be used in concrete for decorative purpose.
- The major purpose of light transmitting concrete is created as a model and the light transmission is made of the illuminating side of the concrete.
- This decorative concrete can be used in interior design of buildings as panels in slabs, walls etc.
- The decorative concrete can be used in place of windows because it can transmit the sunlight.
- Hence the application of optical fiber will make the concrete decorative as well as can make the concrete structural efficient.

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