

# TRANSPARENT CONCRETE

<sup>1</sup> Shraddha D. Uikey, <sup>2</sup> Payal N. Gaddamwar, <sup>3</sup> Ruchita D. Morkhand, <sup>4</sup> Paritosh G. Jadhav,<sup>5</sup>  
Samiksha B. Wankhede , <sup>6</sup> Assistant Prof. Priyanka Nagdeve

<sup>1,2,3,4,5</sup> Final Year Student, Civil Engineering department, SCET, Nagpur

<sup>6</sup> Prof. Civil Engineering Department, SCET, Nagpur

**Abstract** 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. With the increase in population there have been an aggressive increment in demand for energy but the continuous exploitation of conventional sources of energy have led to global warming and its other harmful effects. . Small buildings are replaced by high rise buildings and skyscraper. This arises one of the major problem in deriving natural light in building, due to obstruction of nearby structures. Translucent concrete allows light to pass through it because of the presence of optical fibers within the opaque concrete wall. The principal objective of this project is to design translucent concrete blocks with the use of glass optical fibers, and then analyze their various properties and characteristics growth.

**Index Terms-** Transparent Concrete, Optical Fibers, Compressive strength

## I. INTRODUCTION

Concrete has a key role in development of infrastructure and housing. Small buildings are replaced by high rise buildings and sky scrapers. More and more large-scale civil engineering structures such as tall buildings, underground buildings and landmark buildings and so on are built around the world. Translucent concrete is an innovative solution towards significantly reducing the need for artificial lighting. Natural light is a form of energy reflected as electromagnetic wave that contains full spectrum of the sunlight, which is healthy for human beings and a preference than artificial light. All these functional materials only focus on the intelligence characteristics, and cannot possess energy saving.

While the transparent concrete mainly focuses on "transparent" and its application object is art design. This concept of transparent concrete is first put forward by Hungarian architect, Aron Losonczy, first introduced the idea of light transmitting concrete and the first transparent concrete block is 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. It is worth mentioning that Italian Pavilion in Shanghai Expo 2010 shows a kind of transparent concrete developed by mixing glass into concrete in 2010. Since concrete is strong in compression and weak in tension and flexure.

## Scope and Objective

1. Preparation and study of transparent concrete.
2. Energy saving can be done by utilization of transparent concrete in building.
3. To compare the conventional concrete with the transparent concrete.

4. To compare the conventional concrete with 10%, 15% and 20% replacement of optical fiber.

To compare the compressive strength 10%, 15% and 20% replacement of optical fiber cement block

## II. MATERIAL AND METHODOLOGY

**Cement:** Ordinary Portland cement of 53 grade conforming to Indian Standard IS 12269-1987 was used throughout the experimental program. The standard consistency was 30.5%, whereas the initial and final setting times were 152 min. and 213 min. respectively. The specific gravity of cement was 3.14 and its compressive strength after 28 days was 70.6 MPa.

**Water:** Potable water conforming to IS 456-2000 was used for casting and curing.

**Optical Fibers:** Optical fibers are flexible, transparent fibers made up of glass as well as plastic and are thin as human hairs. It transmits light between two ends of the fibers by process of total internal reflection. In this experiment, the holes of 5mm diameter were drilled and glass optical fibers of 0.5mm diameter were used.

**Sand:** Sand is naturally available material which is composed rock and mineral particles. It is found in different sizes but the size of sand should pass through 1.18mm sieve. It should be free from impurities such as vegetation and gravels.

### Preparation of translucent concrete

The self-compacting mortar used in the production of translucent concrete was designed A total of 9 cubic specimens of dimension 15x15x15 cm were prepared with POF diameters of 3 mm.

The preparation of formwork for translucent concrete is shown in Fig.



Fixation of POF in low-density polyethylene sheets

### Manufacturing process

The manufacturing process of transparent concrete is almost same as regular concrete. Only optical fibers are spread throughout the aggregate and cement mix. Small layers of the concrete are poured on top of each other and infused with the fibers and are then connected. Thousands of strands of optical fibers are cast into concrete to transmit light, either natural or artificial. Light-transmitting concrete is produced by adding 10%, 15%, 20% optical fibers by volume into the concrete mixture. The concrete mixture is made from fine materials only it does not contain coarse aggregate. Thickness of the optical fibers can be 3 mm to suit the particular requirements of light transmission. Automatic production processes use woven fibers fabric instead of single filaments. Fabric and concrete are alternately inserted into molds at intervals of approximately 2 mm to 5 mm. Smaller or thinner layers allow an increased amount of light to pass through the concrete. Following casting, the material is cut into panels or blocks of the specified thickness and the surface is then typically polished, resulting in finishes ranging from semi-gloss to high-gloss.



**Translucent concrete blocks**

### Material Specifications

Si No	Material	Specifications
1	Cement	53 Grade
2	Sand	2.36 mm Sieve Passing
3	Optical fibers	3mm Diameter Strands
4	W/C Ratio	0.45– For Optical Fiber

### Compressive strength of cement block

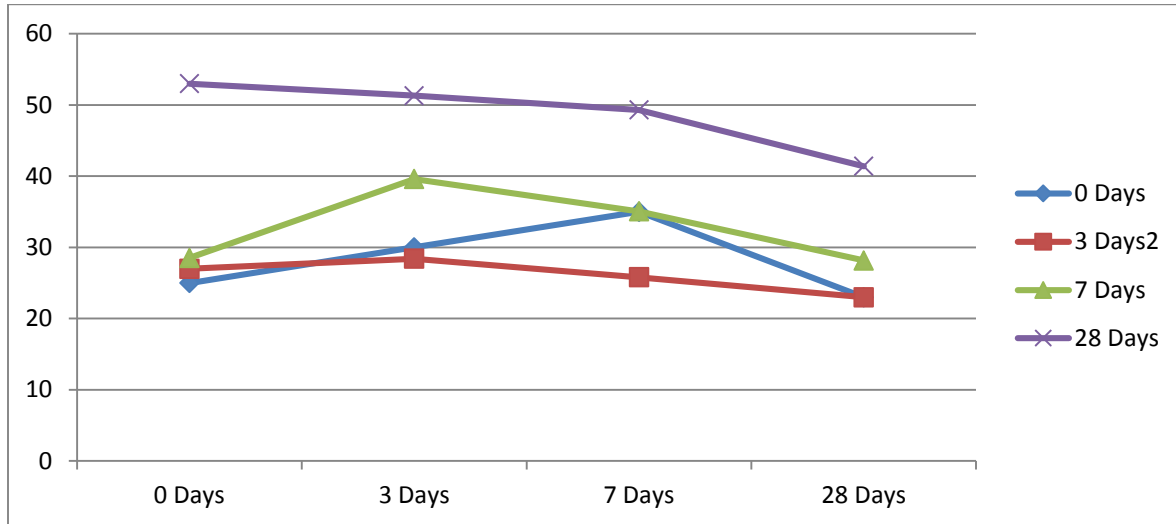
TESTS	REQUIRED RESULT	OBTAINED RESULT
Compressive strength	3 days 7 days 28 days	37.5 N/mm <sup>2</sup> 47.8 N/mm <sup>2</sup> 53 N/mm <sup>2</sup>

### Compressive strength of concrete using optical fiber

OPTICAL FIBER	3 DAYS	7 DAYS	28 DAYS
0% OPTICAL FIBER	27.00	37.00	53.00
10% OPTICAL FIBER	28.4	39.6	51.3
15% OPTICAL FIBER	25.8	35.05	49.3
20% OPTICAL FIBER	23.0	28.15	42.4

### III. RESULT AND DISCUSSION

The compressive strength of cement block is found out to be



**Strengths VS Days Curve  
Different replacement of optical fiber**

Sr. No.	Optical Fiber Replacement	W/C Ratio	Ingredient	Quantity (Kg)
1	0% Optical Fiber	0.5	Cement	0.9
			Optical Fiber	0
			Total	0.9
2	10% Optical Fiber	0.5	Cement	0.81
			Optical Fiber	0.01
			Total	0.82
3	15% Optical Fiber	0.5	Cement	0.75
			Optical Fiber	0.16
			Total	0.91
4	20% Optical Fiber	0.5	Cement	0.7
			Optical Fiber	0.22
			Total	0.92

### IV. CONCLUSION

1. The optical fiber produced using Ordinary Portland cement and therefore is suitable for used in block making.

2. The compressive strength of the blocks for all increases with age at curing and decreases as the optical fiber increases.
3. The compressive strength of Light OPC was found to be ranging between 20 – 23 N/mm<sup>2</sup> with optical fiber specimen and which indicates that the concrete satisfies the compressive strength requirement for M20 grade concrete.

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