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Experimental Analysis of Translucent Concrete

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ABSTRACT: *Concrete has been used since Roman times for the development of infrastructure and housing, but its basic components have remained the same. Three ingredients make up the dry mix: coarse aggregate, consisting of larger pieces of material like stones or gravel; fine aggregate, made up of smaller particles such as sand; and cement, a very fine powder material that binds the mix together when water is added.*
It is no longer the heavy, cold and grey material of the past; it has become beautiful and lively. By research and innovation, newly developed concrete has been created which is more resistant, lighter, white or coloured, etc. Concrete has learned to adapt to almost all new challenges that appeared. In 2001, the concept of transparent concrete was first put forward by Hungarian architect Aron Losonzi at the Technical University of Budapest, and the first transparent concrete block was successfully produced by mixing large amount of glass fibre into concrete in 2003, named as LiTraCon.

KEYWORDS: *Optical fibre, light passing, wooden mould, drilling bit*

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I. INTRODUCTION

This material is becoming more popular due to its unusual properties. Its high strength and transparent character are related with aesthetic value of concrete. Several examples of applications of this material.
Architecture is much more than just erecting buildings. Since people left caves, they have started building shelters. Later on, they began to take care of appearance of their places of living, transforming ordinary buildings into works of art.
Construction technologies and building materials have been developing for a very long time and very quickly. A construction material which is constantly being modified in order to improve its properties is concrete.
Tendencies shaping its quality and development are described in numerous scientific papers. The strength of concrete, its durability and usability are systematically modified so that the buildings made in this technology can be higher, with larger span, and prolonged period of their use.

II. MATERIALS USED

1.Aggregate: To be used in work should be hard, durable and clean. The aggregate should be completely free from lumps of clay, organic and vegetable matter. Fine dust etc. the aggregate should be uniformly graded.
2.Sand: It should have less silt container. which attract moisture from atmosphere.
3.Cement: Ordinary Portland cement having 43 grades can be used, 53 grade ordinary Portland cement develops crack in early stages and also after construction because of heat of evaluation. These 43 grades develop strength slowly. Ultimately it reaches the same strength as 53 grades.
4.water: Water used should not have salts as it caused efflorescence. water available for potable purpose is only used in construction and during cursing purpose
5.Optical fibre: the optical fibre is of size 0.5, 1, 2mm in diameter.

III. ADVANTAGES AND DISADVANTAGES OF LITRACON

ADVANTAGES	DISADVANTAGES
resistant of compression - 50 N/mm2 and bending - 7 N/mm2	compressive strength is classification as standard
blocks may have different dimensions (even 30 x 60 cm)	square meter thickness of 2.5 cm costs about 750 euro
may be construction material which allows to build several-meter-high walls with light transmitting	available only in the form of ready, it can't be made on the building site
changes in the intensity of light, referred as "light information", are transferred from the brighter side of the wall to darker side without major changes (including colour), due to the parallel arrangement of the fibres	
reduction of energy due to the penetration of daily light into the object	

IV. APPLICATION

- Illuminate Your Walls
- Watch Your Pavement Shine at Sunset
- Get Creative with Design
- Transparent concrete blocks suitable for floors,
- pavements and load-bearing walls.
- Facades, interior wall cladding and dividing walls based on thin panels.
- Partition's wall and it can be used where the sunlight does not reach properly.
- In furniture for the decorative and aesthetic
- Light fixtures.

V. MANUFACTURING PROCESS

THE MAKING PROCESS

The manufacturing process of transparent concrete is almost same as regular concrete. Only optical fibres are spread throughout the aggregate and cement mix. Small layers of the concrete are poured on top of each other and infused with the fibres and are then connected. Thousands of strands of optical fibres are cast into concrete to transmit light, either natural or artificial. Light transmitting concrete is produced by adding 4% to 5% optical fibres 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 fibres can be varied between 1 mm and 2 mm to suit the particular requirements of light transmission. Automatic production processes use woven fibres 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.

MAKING THE WOODEN MOULD FOR THE CONCRETE

The wooden mould should be in the size of 150 x150 x150 mm in size and the wooden mould should be screwed by screw for the reusing the mould for the concrete preparation

WOODEN CONCRETE MOULD

MAKING PORES IN THE MOULD

By the use of drilling machine, we had put the holes in the wooden mould of diameter 1mm and 2mm by the drill bit for the purpose of inserting the optical fibre in the mould

MAKING PORES IN WOODEN MOULD

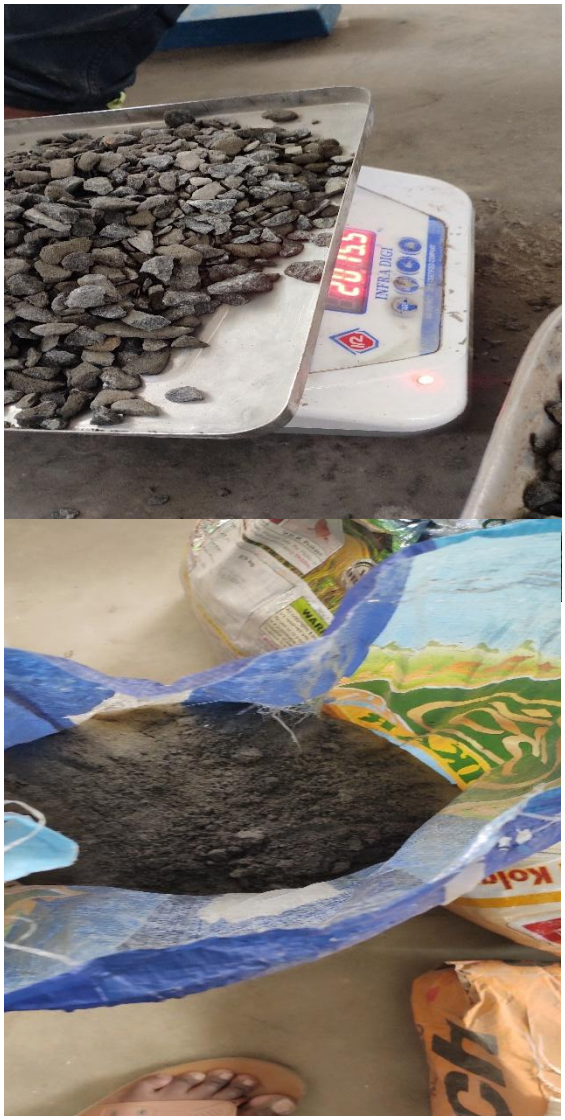
INSERTING THE OPTICAL FIBRE IN MOULD

After making holes in the mould, we had inserted the optical fibre of diameter of 1mm and 2mm in the wooden mould

INSERTING OPTICAL FIBRE IN MOULD

VI. CONCRETE MIX DESIGN

The concrete mix ratio of the optical fibre concrete is M20 as per the Is 456



COARSE AGGREAGATE AND FINE AGGREGATE

After calculating the amount of aggregate, the quantity for the one cube mould of concrete is calculated by using it. after the calculating the amount of aggregate the concrete is mixed as per the Is code 456

The water cement ratio of the transparent concrete is 0.50 as per the mix design ratio

The total amount of concrete material required
For the M20 grade = 1:1.5:3

Total dry material required per cubic meter of concrete= 1.55 cu.m
Total material required for 150 mm concrete cube = 1.55x0.003375
= 0.0052 cu.m (dry volume)

Total parts = 1 + 1.5 + 3 = 5.5

Volume of 1 part = (1/5.5) x 0.0052
=0.00095 cu.m

Volume of cement = 1 x 0.00095 =0.00095 cum
Weight of cement= volume x density
= 0.00095 x 1440
=1.368 kg

Weight of sand = 1.5 x 1.368
=2.052 kg

Weight of coarse aggregate =3 x 1.368
=4.104 kg

For the 10 cube of concrete the required amount of cement =14 kg
For the 10 cube of concrete the required amount of fine aggregate =20 kg
For the 10 cube of concrete the required amount of coarse aggregate =40 kg

VII. COMPRESSION TEST ON TRANSLUCENT CONCRETE

COMPRESSION TEST

Compressive strength of a material is that the value of uniaxial compressive strength when the material fails completely. The compressive strength of the concrete is determined by the cube size of 150 x 150 x 150 mm and then applying the load gradually without the shock and continuously at the rate of 140 kg/cm^2/minute till the specimen fail

Both the conventional and translucent concrete samples, cast with same mix design, were subjected to compressive strength test at 7-day and 28-day. The periods being reckoned from the completion of vibration. The final compressive strength of both concrete shall be the average of three individual cubes for each period respectively.

Data

Mould size 150 x150x150mm
Mix ratio M 20 for the concrete
Solution :
compressive strength of concrete = 460x 1000/22500

=460000/22500

= 20.4 N /mm^2

TRANSPARENT CONCRET IN CTM MACHINE

Compressive strength vs optical fiber

It can be observed that the volume of proportion affects the compression strength of the concrete block for less than 10% when the proportion ratio of the optical fiber is less than 5%

Compressive strength for 28 days

Proportion or size	0.0 (conventional concrete)	0.5 mm	1 mm	2 mm
Test data for the 28 days	480	420	460	470
	495	420	455	460
	485	420	460	460
Average	21.62	18.66	20.4	20.5

VIII. LIGHT PASSING

LIGHT PASSING THROUGH CONCRETE BY NATURAL SUNLIGHT

The natural sunlight is passes through the optical fibre inserted in the concrete through the holes.the main success of our project is that the light that passes through the one of concrete to the other side of the concrete.

The picture shown below has shown that the light is passes through the concrete through the natural sun light without any of the external source of light had been applied

TRANSPARENT CONCRETE BY NATURAL LIGHT

LIGHT PASSING THROUGH THE OPTICAL FIBRE BY ARTIFICIAL LIGHT

The artificial light is passes through the optical fibre inserted in the concrete through the holes.the main success of our project is that the light that passes through the one of concrete to the other side of the concrete.

The picture shown below has shown that the light is passes through the concrete through the artificial light with any of the external source of light had been applied

FIG:ARTIFICIAL LIGHT PASSING THROUGH THE OPTICAL FIBRE OF 1 mm AND 2 mm

IX. COST COMPARISION

COST FOR THE NOMINAL CONCRETE

For the 10 cubes of concrete block
weight of cement =14 kg
Price – 140 INR

Weight of fine aggregate=20kg
price – 140 INR

Weight of coarse aggregate = 40 kg
Price – 100 INR

Total =380 INR

COST FOR THE TRANSLUCENT CONCRETE

For the 10 cube of transparent concrete block

Weight of the cement = 14kg
price- 140 INR

Weight of the fine aggregate=20kg
Price=140 INR

Weight of coarse aggregate=40kg
Price=100 INR

Wooden mould 10 nos =2400 Inr

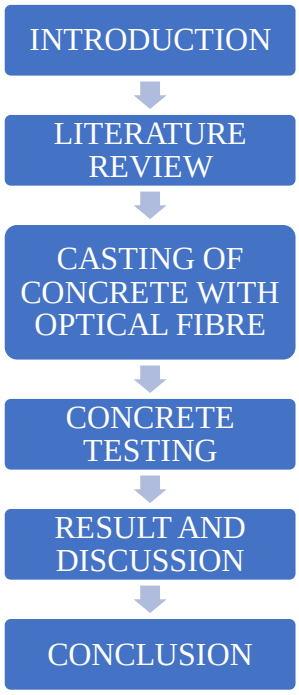
Optical fiber=3070 INR

Drilling bit and key=150 Inr

Total= 6000 INR

TRANSLUCENT CONCRETE

X. METHEDOLOGY



XI. CONCLUSION

The transparent concrete is a good architectural material. As discussed in various papers the strength of concrete is reduced by some amount but it can be achieved by using some addition fibre, therefore the strength parameter of transparent concrete is same as conventional concrete. Transparent concrete give aesthetical view to buildings. It is energy efficient and makes green building.

A novel construction material named smart transparent concrete was developed using POF and FBG. The light transmitting, mechanical properties and self-sensing performance were cautiously investigated and the stated hypothesis of its light guiding capability was confirmed.

FBG arranged in concrete can sense the inner deformation of concrete specimens under pressure and the changing tendency of the internal fiber grating is consistent with that shown in the electric resistance strain gauge tests.

Such research and experimentation provide solid evidence for the intelligence of this system in structural safety assessment. With regard to the energy-saving aspect, POF-based concrete allows the use of sunlight for illumination; in the case of emergencies, transparent concrete will provide some relief in the case of daytime power outage for skyscrapers, making evacuation safer and more efficient. Additionally, a smart transparent concrete is aesthetically pleasing. POF-based transparent concrete could be regarded as an art which could be used in museums and specific exhibitions rather than just a construction material.

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