

EXPERIMENTAL ANALYSIS OF TRANSLUCENT CONCRETE BY USING PLASTIC OPTICAL FIBERS

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ABSTRACT: This article deals with the usage of translucent concrete and also advantages it brings in the field of smart construction. In past various type of construction were developed for construction work which are light in weigh ,self-compacted ,but after the development of such concrete there some problems occur also situated in the buildings is dark ness .In urban area where multi-storied building is situated very attached to each other there is dark ness in the room in day time also. These problems can be solved by translucent concrete allows light pass through it because of the presence of plastic optical fibers. Therefore light transmitting concrete is one option that utilizes 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 optical fibers in cement mortar.

In day time it transmits sun light to room and at the night time it gives the good appearance of building .Light transmitting concrete pass light through it because of plastic optical fibers are putting into the cement mortar. Compressive strength of translucent 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].

Key Words: plastic optical fiber, translucent concrete, compressive strength, light transmitting characteristics, Port land cement, tension strength.

1. INTRODUCTION

Translucent concrete is a concrete that transmitted light through it by utilizing plastic optical fiber. It is a material which makes green structure. Traditional cement made with bond sand and total and water which can't transmit the light translucent cement is made with bond, sand and many plastic optical fiber in cement starting with one face then onto the next face which guide the light going through it. Translucent concrete otherwise called light-transmitting concrete or transparent concrete.

The principal translucent concrete was referenced in the 1935canadian patent. The idea of light-transmitting cement came in 2001 which is presented by Hungarian designer, Aron Losoczi at the Technical University of Budapest, and the principal straightforward solid square was effectively created by blending a lot of plastic optical

fiber into concrete2003, named as LiTraCon. Because of improvement of plastic optical fiber takes a shot at translucent solid will expand .the translucent concrete completely centered around straightforwardness and its applications and furthermore targets relate to masterful completion and green innovation, It is the blend of " plastic optical strands and fine concrete ".At present, green structures fundamentally keen on sparing vitality with indoor warm frameworks. Because of globalization and the development of multi-storeyed structures, the space between houses is diminished, this causes to expand the utilization of non-sustainable power sources, so there is a requirement for brilliant development methods like green structure and indoor warm framework.

1.1 PRINCIPLE OF LIGHT TRANSMITTING CONCRETE

Normal light and daylight give the full range of hues radiating through the solid boards or blocks .daylight is the most reasonable light source .if the board or blocks are mounted unattached off before a window, one won't require any fake light source. Straightforward concrete or translucent cement is because of work based on "Nano-optics" .transparent concrete fundamentally takes a shot at "all out inner reflection". Optical fiber go as much light when modest cuts are put legitimately over each other. Optical strands in the solid demonstration like the cuts and convey the light over the solid.

1.2 OBJECTIVES

1. To study strength characteristics of translucent concrete
2. To compare strength characteristics of normal concrete and translucent concrete.
3. To check the light transmittance of the translucent concrete.

2. LITERATURE REVIEW

Numerous specialists have considered the designing properties of plastic optical fibers in the concrete.

3. MATERIALS AND PROPERTIES

This chapter briefly describes the final results of the properties of all materials used in this project. The IS codes (Indian Standard) important practice considered for

all tests in the reference and all test on materials were performed by the code system is pertinent and rules.

3.1 CEMENT

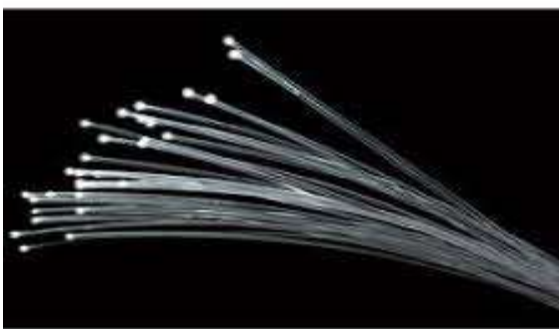
As the plastic optical fiber is in charge of the transmission of light, there is no unique bond required. So conventional Portland bond is utilized for translucent cement.

3.2 FINE AGGREGATE

Stream sand has been sieved from IS 2.36 mm strainer. It doesn't contain any polluting influences, for example, vegetable issues, natural issue, protuberances, etc.

3.3 PLATIC OPTICAL FIBER

An optical fiber is an adaptable, translucent fiber made of plastic, to a breadth marginally thicker than a human hair. Optical strands are utilized frequently as a way to transmit light b/w two parts of the bargains. The field of applied science and building worried about the structure and use of optical strands is known as fiber optics. Fiber optical strands are extensively used in fiber-optic interchanges where they award transmission over longer detachments and higher data transfer capacities [data rates] than wire connections are used instead of metal wires since sign travel along them with less misfortune and are moreover impervious to electromagnetic impedance. Filaments are moreover used for enlightenment and are enclosed by packs so they might be utilized to pass on pictures. In this way permitting review in limited spaces. Exceptionally structured strands are used for various applications including sensors and fiber lasers.



Optical strands commonly incorporate a straightforward center encompassed by a straightforward cladding material with a lower record of refraction. Light is kept in the inside by absolute inner reflection. this in light of the fact that the fiber to go about as a waveguide .filaments that help numerous spread ways or transverse mode are called multi-mode strands [MMF], while those that lone help a solitary mode are called single-mode fibers[SMF]. Multi-mode strands for the most part have a more extensive center measurement and are utilized for

short-separation correspondence joins and for application where high power must be transmitted. Single-mode filaments are utilized for most correspondence interfaces longer than 1000 meters [330 feet]. These can have distances across up to 2mm .plastic optical fiber enables us to transmit daylight or light from any source to go through it. At the point when utilized in cement these filaments transmit light that falls on one face of the solid to different countenances. There is practically zero sign misfortune in the plastic optical fiber when light goes through its center. Plastic optical fiber of measurement 1 mm has been utilized for planning tests.

WATER

Water is a key ingredient, clean potable water used from the tap in concrete lab. This water was used in making fine concrete specimens. Water was free from suspended solids and natural materials, which could have influenced the properties of later and solidified fine concrete. The PH estimation of the water was 7.0

FLY ASH

At the point when coal is scorched in the present current electric producing plants, ignition temperatures reach roughly 2800 °F .the non-flammable minerals that normally happen from consuming coal structure base fiery remains and fly slag.

S.NO	MATERIAL	SPECIFICATION
1.	Cement	53 grade
2.	Sand	2.36 mm sieve passed
3.	Plastic Optical Fiber	1 mm diameter used
4.	Water-Cement Ratio	0.40

3.6 MIX COMPOSITION AND SPECIMEN PREPARATION

The assembling procedure of translucent cement is like customary cement. Just plastic optical filaments are utilized in this translucent cement. Plastic optical fiber is spread all through the concrete blend. Hundred of plastic optical filaments are thrown into bond blend to transmit light either characteristic or counterfeit. Light transmitting cement is created by adding 3 to 5 level of plastic optical strands by volume into the solid blend. The solid blend is produced using fine materials just it doesn't contain any coarse total. The thickness of the plastic optical fiber can be shifted from 0.25 mm to 2 mm. In this trial, we are utilized 1 mm is utilized.

In this experiment has four blocks casted each one has in different properties as below as

First block is 100% of cement, sand, optical fiber.

90% cement, 10% fly ash and sand, optical fiber

Another block is 80 % cement, 20 % fly ash, sand, optical fiber.

Fourth block is 70% cement, 30% fly ash, sand, optical fibers.

Before filling these cubes with cement mix they were coated with oil, with the goal that the fine solid 3D shapes would not hold fast to the molds. The threw shape was kept undisturbed on the leveled plat structure. At that point it was de-formed cautiously following 24 hours from throwing. Following de-formed the block examples were set apart by their separate distinguishing proof of imprints/numbers. Cut the extra - long strands same as thickness of form. Clean the squares surface by utilizing cleaning paper or utilizing sand paper

4. EXPERIMENTAL PROGRAM

We have maintained the various types of mix designation casting moulds calculated the compressive test, light transmittance test and durability tests.



Figure: Compression Test Machine



Fig: Compressive strength using UTM Machine

compressive test is a simple test to perform and somewhat in light of the fact that the qualities properties of fine cement is alluringly identified with its compressive quality .the test is done on examples like 3D cubes. In this test we are casted by Five cubes of size 7 cm x7 cm x 7 cm. one cube was of regular fine concrete has 100 % cement,

sand . Another cube of 100% cement, sand, fibers and also third cube was 90% cement, 10 % fly ash, sand, fibers one more cube was 80% cement, 20% fly ash, sand, and fibers. Fifth cube was made up of 70% cement, 30 % fly ash, sand, fibers. The optical fibers in compressive fine concrete were distributed in horizontal direction. Before filling these cubes with cement mix they were coated with oil, so that the fine concrete cubes would not adhere to the moulds. The compressive strength of these cubes was found out using compressive testing machine (CTM)



Fig: After testing on the compressive test on moulds



LIGHT DEPENDENT RESISTOR

The light transmission through the sample can be estimated by the current relating to the light which can be estimated by a light-dependent resistors[LDR]. The utilization of photodiode would require a different sensor which would expand the task cost profoundly. The majority of interchange decision would be LDR.

The LDR estimates the light transmitted through the example and changes over it into the current, which for this situation is estimated in mill amperes [mA]. so two readings are taken, one without test [A1] and one with test [A2]. The source of light here is taken as 100 W bulbs, an resistance of 100 ω is volt is kept b/w the circuits.

The sample is put b/w source and LDR and the test is completed.

$$\text{Light transmittance} = 100 - (A1 - A2 / A1) \times 100$$

Where,

A1= light transmitted without test

A2= light transmitted with test



Fig: light transmittance of the cement mortar brick

5. RESULTS AND DISCUSSIONS

5.1 COMPRESSIVE TEST

The compressive quality is estimated on the cubic 7x7x7 cm examples as per the Indian standard Tests were tried for the compressive quality at 28days of age.

S.NO	FINE CONCRETE SPECIMENS	COMPRESSIVE STRENGTH WITH 28DAYS CURING [n/mm ²]
1.	M ₀	31.09
2.	M ₁	25.04
3.	M ₂	30.06
4.	M ₃	28.05
5.	M ₄	26.05

Normal (M₀) = cement, sand, water

0% Fly ash (M₁) = cement, sand, added plastic optical fibers.

10% Fly ash (M₂) = 90% cement, 10% Fly ash, sand added fibers

20% Fly ash (M₃) =80% cement, 20% Fly ash, sand added fibers

30% Fly ash (M₄) =70% cement, 30% Fly ash, sand added fibers

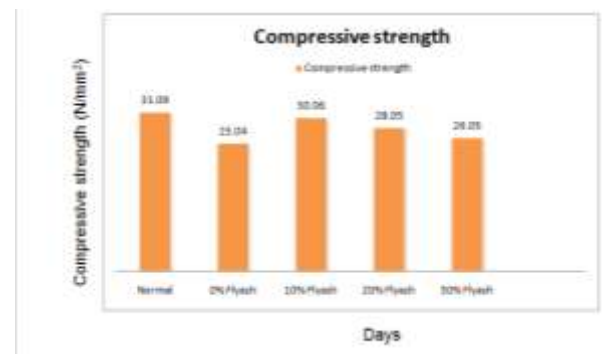


Figure: Fixing of fibers in the brick mould



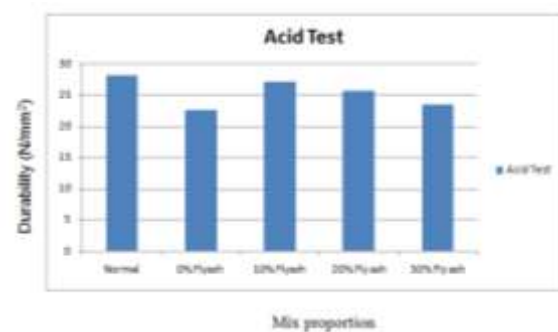
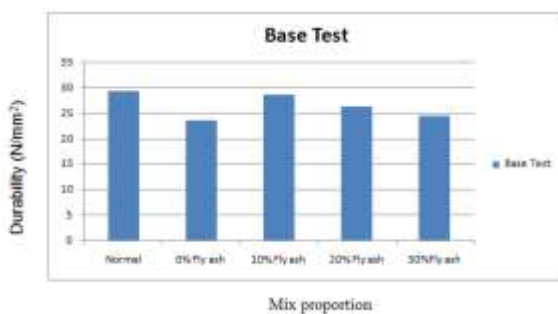
Figure: trimming and cleaning of the surface

We have observed the mix proportions, we got maximum compressive strength at M_0 i.e. $M_0=31.09$ Normal mortar

5.2 DURABILITY TEST

To check durability of cement mortar mix, Cubes of size 7cmX7cmX7cm was casted using different mix proportion. Next After 24 hours the specimens will remove from the mould and subjected to water curing for 28 days. The specimens were taken out from the curing tank and initial weight was taken. After this step, cubes was immersed in salt water for 28 days and again weighted and then weight in loss was calculated.

S.NO	Mix designation	Base curing	Acid curing
1.	M_0	29.49	28.28
2.	M_1	23.68	22.80
3.	M_2	28.68	27.20
4.	M_3	26.28	25.80
5.	M_4	24.47	23.68



Base test:

We have observed the mix proportions, we got maximum compressive strength at M_0 i.e. $M_0=29.49$ Normal (M_0) = cement, sand, water

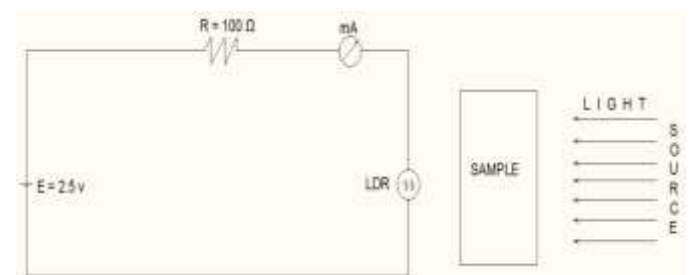
Acid test:

We have observed the mix proportions, we got maximum compressive strength at M_0 i.e. $M_0=28.28$ Normal (M_0) = cement, sand, water

5.3 LIGHT TRANSMITTANCE TEST

During the time spent making light-transmitting fine concrete. The underlying advance associated with the planning of form. The shape can be made with various materials which can be either wood or tin. In this trial, the concrete mortar form is set up with tin material. In the form readiness, it is imperative to fix the elements of bond mortar squares. Separate form arranged to build these hinders, the element of our shape is 20[L] x10[B] x 5[H] cm. In the form, markings are made precisely, so the punctured plates can be utilized. plates made up of sheets. Denoting the form utilizing scriber after openings are penetrated into the plates. The measurement of the gaps and no.of gaps for the most part relies upon the level of plastic optical fiber are utilized. In this test, we have utilized a 1 mm width of plastic optical fiber.

Input voltage (v)	Without specimen (A1)	Mix designation	Output	
			Current [mA]	Light (%)
2.5	3.0	M_1	0.48	16
2.5	3.0	M_2	0.70	23.4
2.5	3.0	M_3	0.66	22
2.5	3.0	M_4	0.40	13.4



6. CONCLUSION

Transparent concrete block can be utilized from numerous points of view and executed into numerous structures and be profoundly invaluable. The main downside would be the expense is substantial. In any case, that doesn't prevent high-class planners from utilizing it. It tends to be utilized in green structures to build the vitality effectiveness of the structure. It is the eventual fate of structural designing development material and the compressive quality of translucent cement is equivalent to the quality of standard cement and it has the property to transmit light. On the off chance that the level of the plastic optical filaments expanded than the normal solid quality beginnings diminishing, so we can infer that the quality of light-transmitting cement is contrarily relative to light transmittance. Possibly fine totals are utilized in such a case that we utilize coarse totals then it might devastate the plastic optical filaments and changes their properties.

- The trial results got from the examination, the accompanying ends can be drawn :
- The light transmittance execution of the straightforward cement altogether relies upon the rate volume of plastic optical strands joined.
- The dividing and no. of plastic optical strands significantly influence the general proportion of light transmitted.

Light transmittance properties of translucent cement can be tentatively tried utilizing an electric circuit arrangement with a light-needy resistor [LDR].

At the point when the separation b/w the example and light source builds, the measure of light transmitted progressively diminishes. The force of light transmitted through translucent cement bit by bit diminishes concerning separation b/w the LDR example

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