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Translucent Concrete Blocks: A Fusion of Aesthetics and Functionality

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Abstract: *Even though its essential ingredients have changed throughout the centuries, concrete has been around since the Romans employed it to build houses and infrastructure. When mixed with water,cement becomes a very fine powder, coarse aggregate is larger rocks or gravel, and fine aggregate is smaller particles like sand. Due of rapid urbanization in the 1960s, concrete was commonly misinterpreted. However, concrete has advanced scientifically and architecturally.*

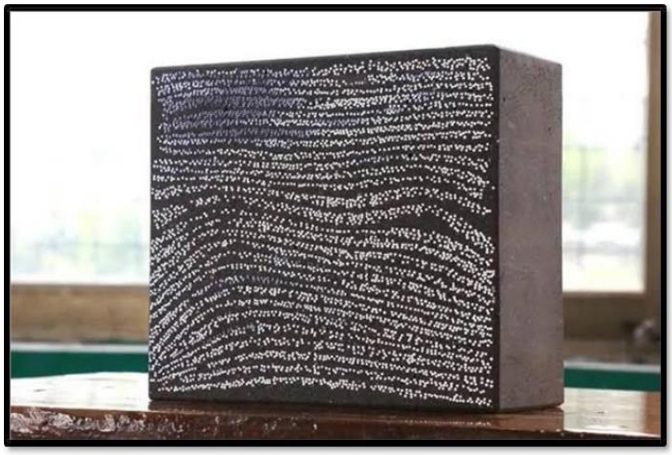
What was dull is now beautiful. Invention and research have generated more durable, lighter, white, or colored concrete. Concrete adapts well to most new challenges. At Budapest's Technical University, architect Aron Losonzi suggested translucent concrete in 2001. For the first transparent concrete block, Litracens, a lot of glass fiber was added to concrete in 2003.

Translucent concrete aspires to be ecologically responsible and beautifully transparent. The description is "optical fibers and fine concrete". In green building design, interior heating system energy efficiency is emphasized. To address the building's safety monitoring (including damage detection and fire warning), environmental protection, energy conservation, and creative modeling objectives, a new practical material is needed.

I.INTRODUCTION

One novel material that has found several uses in building, architecture, interior design, and even furniture is translucent lightweight concrete.

- As expected, translucent concrete will improve the building's connection with its surroundings, resulting in brighter and more naturally lighted spaces and substantially reducing concrete laying and maintenance costs.
- Light passes through thousands of optical filaments lined out side by side. Thin filaments mingle with concrete.
- Natural light is not only more cost-effective than artificial lighting, but it also makes a building a healthier and more aesthetically pleasing place to live. A homogenous substance on the inside and out resulted from the mixing of optical fibers with fine concrete.
- Produced in block form, its primary function was adornment. Light-transmitting concrete is introduced by Li TraCon as a novel, broadly used construction material.
- It has several potential applications, including indoor and exterior walls, lit pavements, and even pieces of art and design.



The fundamental ingredients of concrete have been the same since its usage in Roman times for building infrastructure and houses. The dry mix contains coarse aggregate (pebbles or gravel), fine aggregate (sand), and cement (which binds the mixture when water is introduced). Concrete was misunderstood and disapproved a few decades ago due to rapid urbanization in the 1960s. Since then, concrete has improved technically and aesthetically. There is a growing demand for smart construction techniques such as green building and interior thermal systems as a result of the shrinking space between buildings brought about by globalization and the development of high-rise structures. A relatively recent method that differs from traditional concrete is the creation of translucent concrete. The transparent concrete is lighter and airier than conventional concrete. Transparent concrete uses solar light instead of electricity to reduce non-renewable energy use. Translucent concrete provides natural light and artistic design while reducing the need for artificial lighting; optical fibers are used as sensing or transmission elements.

II.LITERATURE SURVEY

A. Experimental Analysis of Translucent Concrete by Using Optical Fibers

Nikhil k: Making clear concrete is quite similar to making normal concrete. Optical fibers are dispersed within the cement and material. Thin layers of concrete are poured, blended with fibers, and connected. Concrete contains hundreds of optical fibers for natural or artificial light transmission. Light-transmitting concrete contains 4–5% optical fibers. The concrete mixture contains just fine aggregate. The thickness of optical fibers may be changed from 2 µm to 2 mm to fulfill individual light transmission demands. Concrete is placed into molds at intervals of about.5cm to 1cm in automatic manufacturing methods, which employ woven fiber fabric instead of single filaments. A greater quantity of light may penetrate the concrete when the layers are smaller or thinner. Cutting and polishing material into panels or blocks of the proper thickness produces semi-gloss to high-gloss finishes

B. Experimental Analysis of Translucent Concrete by Using Plastic Optical Fibers

S. Yasod kumar, M. Praveen kumar: Translucent cement is much like regular cement in terms of its assembly process. This see- through cement makes use of just plastic optical filaments. The concrete mixture is filled with plastic optical fiber. Light, real or fake, may be transmitted by combining hundreds of plastic optical filaments in a bond mix. The solid mixture is then enhanced with three to five levels of plastic optical strands by volume to produce light-transmitting cement. There is no coarse total in the solid mix, which is made from fine components. Plastic optical fibers are adjustable in thickness from 0.25 mm to 2 mm. One millimeter was used in this experiment. This experiment utilizes four cast blocks, each with its own unique set of attributes, as seen below: Cement, sand, and optical cable make up the whole first block. optical fiber, sand, and fly ash make up 10% of the mixture, with cement reaching 90%. Cement, fly ash, sand, and optical fiber make up another block. Cement, fly ash, sand, and optical fibers make up the fourth block, with 50% each. To ensure that the tiny solid 3D forms would not stick to the molds, they were sprayed with oil before being filled with cement mix. The flat plat construction allowed the tossed form to remain intact. Careful deformation occurred 24 hours after tossing. The following instances of deformed blocks were identified by unique imprints or numbers. Take the form's thickness into account while cutting the extra-long strands. Use sandpaper or cleaning paper to smooth down the surfaces of the squares.

C. Transparent Concrete as A Green Material for Building:

Aswathi. R, Athira. B, Devika. M, Arun. T.R, Mr. M. Sudharsanan: Seven 15x15-centimeter cubes were made. Some cubes make transparent concrete, others ordinary concrete. Cubes and other solid examples have variable quantities of optical plastic fibers.

The optical fibers in the see-through concrete made up 1% and 2% of the total volume of the cubes, and they were evenly dispersed vertically at a distance of 5 cm. Every cube in the transparent concrete set has its own set of holes cut into it to accommodate the vertical passage of optical fibers; Steel 15 cm x 15 cm x 15 cm molds with wooden bases were utilized. To prevent concrete from adhering to molds, these cubes were greased before filling. The Universal Testing Machine measured cube compressive strength.

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III.OBJECTIVE

- Transparent concrete's main purpose is to reduce non-renewable energy use and replace electricity with solar energy.
- In order to pour a unique kind of concrete that can transmit lightIn order to learn about their light-emitting properties and create a material that is both functional and aesthetically pleasing, we need to research them. In terms of the building's aesthetics, it possesses extremely desirable architectural qualities.
- Translucent concrete may help reduce a building's energy use.
- This project's overarching goal is to create a sustainable, aesthetically pleasing, and environmentally friendly construction material.

Fig.2

Methodology [Flow Chart]

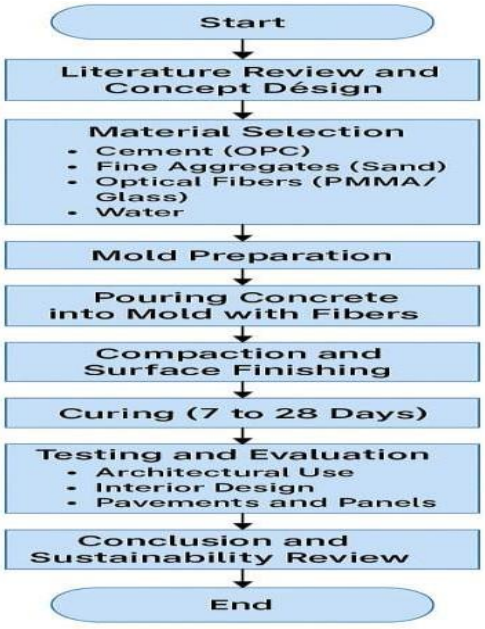
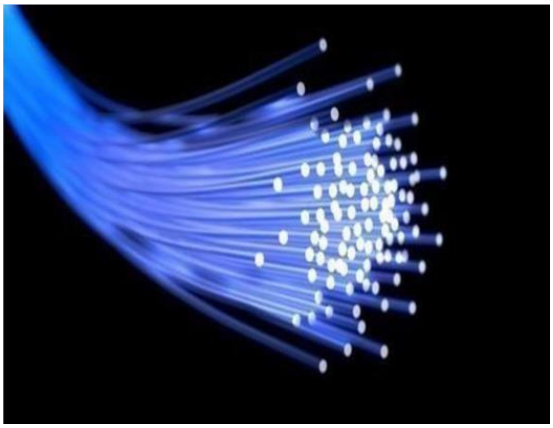
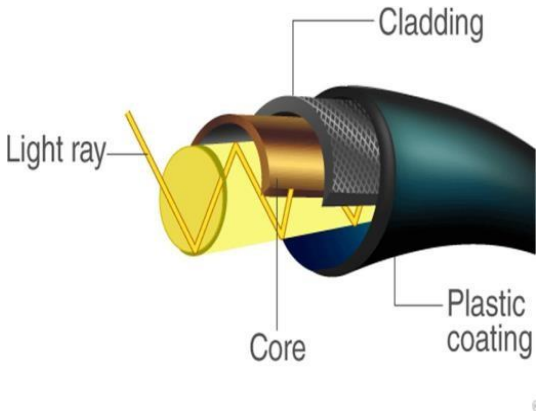


Fig3: Flow chart

IV.MATERIALS

Optical Fiber: The glass or plastic filaments that make up this flexible, see-through fiber let light to pass through from one end to the other. The fibers are 6 and 8 mm thick.





Cement: Grade 53 Ordinary Portland Cement was used in this project.

Fine Aggregate: A 600 MICRON IS sieve is used to filter sand.

Water: The concrete may be mixed with potable water. Ordinary.

Epoxy: Epoxy refers to a family of resins that begin with epoxy and conclude with cured epoxy.

Preparation of Mould:

Light-transmitting concrete begins with mold preparation. Wood or tin can be used for the prototype's mold. Fixing the mold's basic dimensions is crucial to preparation. According to IS 456-2000, the smallest acceptable concrete cube dimensions are l5cm x l5cm x l5cm. In order to employ the perforated plates, the mold is marked precisely according to the cube's size. Perforations and mold smoothing are done using electrical switch board sheets. Plates have holes drilled.Hole width and number depend largely on fiber percentage.

Manufacturing Process:

Making clear concrete is quite similar to making normal concrete. Optical fibers are dispersed within the cement and material. The process begins with pouring thin layers of concrete, which are then mixed with fibers and joined. To allow natural or artificial light to pass through, thousands of optical fibers are embedded in concrete. Light-transmitting concrete contains 4–5% optical fibers. The concrete mixture contains just fine aggregate. The thickness of optical fibers may be changed from 2 µm to 2 mm to fulfill individual light transmission demands.Automatic production uses woven fiber fabric instead of filaments. Between half a centimeter and one centimeter intervals, molds are filled with fabric and concrete, in that order.A greater quantity of light may penetrate the concrete when the layers are smaller or thinner. Once cast, panels or blocks of the necessary thickness are cut and polished to semi-gloss or high-gloss finishes.

V.APPLICATIONS

➢ **Illuminate Your Walls**

Walls both inside and outside a structure may be constructed using transparent concrete. For sunlight-lit walls, facing east or west lets the sun's rays reach the optical glass fibers at a lower angle, creating a brighter light beam. Aside from the usual wall uses, light-transmitting concrete may also be utilized as a backlit wall covering.

➢ **Krebs Shine at Sunset**

A walkable surface lighted from below, this concrete may be used as flooring. At day, it seems to be ordinary concrete pavement; but, after the sun goes down, the paving blocks start to reflect light in a variety of hues.

➢ **Creative Design**

You may utilize the building pieces in all sorts of different ways in terms of design. Jewels and concrete benches were two examples of well-executed designs that made use of light-transmitting concrete. For aesthetic purposes, you may also design a logo using a variety of colorful figures, inscriptions, and photos**.**

➢ **Artsy Reception Desk**

Choosing an artistic and trendy welcome desk with lights along the front and sides is a certain way to make a statement.

➢ **A Lighting fixture and Conversational Piece**

You can not help but strike up a chat with the see-through concrete cube. Four identical slabs of concrete make up the new cube series, and their unique shape ensures that they can stand on their own without any fasteners.

➢ **Both internal and exterior walls may be constructed with it. Light is more intense because the sun's rays reach such concrete at a lower angle.**

• **It can be also applicable at:**

Concrete blocks that are see-through and may be used for flooring, pavements, and walls that bear weight. Wall cladding, interior facades, and partitions constructed from thin panels.

➢ Walls that serve as partitions and may be used in areas where natural light is inadequate.
➢ In pieces of furniture intended for purely aesthetic reasons.
➢ Electrical light fittings.
➢ Floodlight pathways after dark.
➢ Improving illumination in underground subways
➢ In the case of a power outage, illuminate interior fire exits.
➢ Nighttime illumination of speed bumps on roads.

VI.ADVANTAGES

➢ While the texture of finer transparent concrete becomes blurry at distance, the texture of these goods remains discernible on large-scale items.
➢ A residence may save money on utility bills by turning off more lights throughout the day when its solid walls have the property to transmit light.

- In terms of the building's aesthetics, it possesses extremely desirable architectural qualities.
- Transparent concrete may be used in areas where natural light is inadequate.
- Use of translucent concrete in construction helps reduce energy consumption.
- Because of its light-transmitting properties, it is completely eco-friendly and may help minimize energy use.
- Low Density (translucent concrete typically has a density value between 2320 and 2400 kg/m3).
- The TCP's low thermal conductivity of 0.2114 W/(m·K) makes it a better thermal insulation option than glass curtain walls (GCW) and masonry facades.
- Decrease Superfluous Fat
- Speeds Up the Building Process
- Cuts Down on Energy Use.
- Filler slabs made of translucent concrete are:

Due to the rapid increase in urbanization, buildings are being built very close together, which reduces the amount of natural light that can be used. As a result, artificial light will also be necessary during the day. One alternative to artificial light is the filler slab concept, which can be used on roofs in both residential and commercial buildings.

In modern times, glass is being used in open-to-sky rooftops without proper safety measures in place. These types of roofs are also difficult to maintain. Therefore, it would be very beneficial to include the notion of transparent concrete into filler slab roofs and replace some of the fibers with them when it comes to light that comes from outside.

VII.DISADVANTAGES

- The high price tag associated with the optical fibers is the biggest drawback of this concrete.
- Transparent concrete block casting requires a particular set of skills that the average worker lacks.
- The expensive price of optical fibers
- Not suitable for use in beams and columns
- Given their lack of physical prowess
- The presence of glass fragments makes them potentially harmful to handle.

VIII.CONCLUSION

- The principle of 'Nano Optics,' in which optical fibers function as slits to transfer light from one surface to another, is the basis of translucent concrete.
- The light-transmitting characteristics of LTC are explored in this research.
- Without coarse aggregate, we were able to arrive at the mixture percentage for the mold's casing.
- The versatility and adaptability of translucent concrete blocks make them an attractive and practical material with several potential applications.
- However, its hefty price tag would be the one negative. Even yet, it is still used by elite architects.
- It is a wonderful indicator of chemistry and creative growth.
- Any structure using translucent concrete will draw notice and awe.
- Light-transmitting concrete has the same compressive strength as conventional concrete but transmits light.
- As optical fiber % increases, translucent concrete's strength decreases.

The use of coarse particles could damage the optical fibers and alter their characteristics, hence only fine aggregates are employed.

- This lighted table in a dimly lit room is the perfect example of how transparent concrete works best in settings with a high degree of light contrast.
- Ornamental concrete and plaincement concrete have similar strengths.
- The results show that decorative concrete is strong.
- So, using optical fiber will both make the concrete more aesthetically pleasing and maybe more structurally sound.

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