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Study on Transparent Concrete by Using Plastic Optical Fiber

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Abstract: ***Transparent Concrete is the new type of concrete introduced in today's world, properties of light transmitting due to appearance of light optical fibers. It is known as light transmitting concrete or translucent concrete.***
Also, there are many advantages to using light transmitting Concrete as compared regular Concrete. i.e lightning Occurs, good Aesthetically View, energy saving, etc. The Sample will contain 95 % of Concrete and 5 % of Plastic Optical fibers. Optical fibers Light transmit so Effectively that there is no loss of light conducted through the fibers.
This type of concrete can introduced at average cost of construction and increasing Visual appearance of the building. This paper may help you to understand transparent Concrete for everyone easily.
Keyword: Transparent Concrete, Light transmitting (LTE), Optical fibers, etc.

I. INTRODUCTION

Today, we are living in a world where energy cost and environmental Problem increase to global scale.
The Transparent concrete is also called as translucent concrete. This translucent Concrete is achieved by replacing aggregates with transparent alternate materials.
The transparent appearance mainly due to uniformly distribution of high numerical aperture plastic optical fibers throughout the body. The Concrete is formed by mixing materials such as fine concrete that is cement and fine aggregate with optical fibers. These fibre blend into Concrete like any other aggregate the Capacity to transmit lite from the source into the Space enclosed by panel. The Thickness of the Optical fibers can be Varies between 2um and 2mm. The main reason for using Optical fibre that it can transmit light even at an incident angle greater than 60 degree (> 60°).The use of optical fibers does not have much impact on strength of concrete Compare to normal Concrete.It is Commonly used in the construction of green buildings. Since, it can transmit light this type of concrete is considered energy saving method of construction. It provide very good aesthetic appearance for a building. However casting a translucent concrete required skilled labor's and cost of construction is pretty high.

II. PROPERTY

1) The fiber Can work up to almost 20 m running length without losing light.
2) Versatile building Material.
3) Illumination.
4) Allow more light and less weight compared to normal concrete.
5) It has Compressive strength and tensile strength of 50-80 MPa and bending strength of 7 MPa.
6) Colour remain Same on the other end of the block.

III. LITRATURE REVIEW

Bishettiet al. (2016) had prepared wooden mould of 15cm x 15cm x 15cm by drilling its two faces for holding the optical fiber. Mix design ratio of concrete was taken as 1: 2.24: 1.78.
As the percentage of optical fiber increases, the compressive strength of transparent concrete decreases. Starting from 43.55MPa for 0% optical fiber, it declines up to 31.10MPa for 5% optical fiber.
Paul and Dutta (2013) researched on bending and compression resistance of beams made of translucent concrete. As a result of the research, it was stated that the resistance features of the said material depend highly on the plastic optical fiber density in the concrete element. It was estimated that the plastic optical fiber share in the concrete, which will not worsen its resistance, amounts to 0.8% by applying the plastic optical fibers of the 1.5mm in diameter and of 0.4% steel fibers. What is more, plastic optical fibers can be easily connected with the concrete and they meet the conditions of bending and compression resistance.

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Kamdi (2013) has focused on materials for preparation, mixing procedure, uses, environmental impact and future of TC. He mainly gives an idea about using optical fiber with fine concrete for making transparent concrete. He reveals the fact that TC is not used widely due to its limited application in developing only precast and prefabricated blocks and panels. Nevertheless, by reducing the energy uses, transparent concrete can make a big impact on the environment.

PadmaBhushan M.N.V (2013) et al., in this journal paper light is conducted through the stone from one end to the other. This results into a certain light pattern on the other surface, depending on the fiber structure. Optical fibers transmit light so effectively that there is virtually no loss of light conducted through the fibers. The modelling of such translucent or transparent concrete blocks and their usage and also the advantages it brings in the field of smart construction.

Prof. Momin. A.A.(2014) et al., in this journal paper the transparency of concrete specimens with glass fibers is more as compared to the specimens with glass rods and also justifies the fact that more the transparency of the material more effective will be the light transmittance. Thus the study concludes that the transparency of light is possible in concrete without affecting its compressive strength, as the optical fibers and glass rods act as fiber reinforcement thereby enhancing the strength and also enhances appearance.

Juan Shen(2013) et al., have studied journal paper discusses the development of Smart transparent concrete based on its excellent Properties of transparent and smart sensing. By dealing with its usage and also the advantages it brings in the field of smart construction, we find that it can reduce the power consumption of illumination and use the optical fiber to sense the stress of structures and also use this concrete as an architectural purpose for good aesthetic view of the building.

Akshaya b kamdi (2013) et al.,have studied paper the manufacturing, uses and future scope of transparent concrete is widely given. However, this innovative new material, while still partially in the development stages, is beginning to be used in a variety of applications in architecture, and promises vast opportunities in the future. Translucent concrete is one of the most interesting new takes on the historically stiff and uninspiring building material. It could be used almost anywhere glass or traditional concrete are Used.

IV. DESCRIPTION

Transparent concrete is a concrete based building material with light Tran-missive 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. 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 aesthetic view of the building.

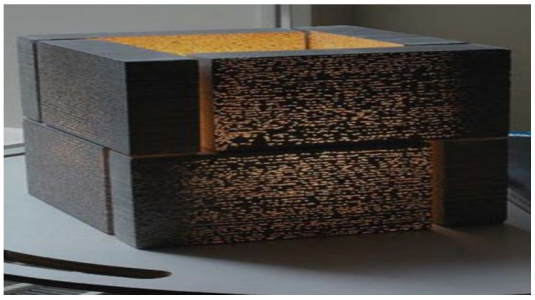


Fig. Transparent 1 Concrete

A. Ingredients Of Transparent Concrete

1) Cement

Cement is a major ingredient of binding material used in concrete. It provides good adhesive property to bind fine aggregate and course aggregate. The major ingredients of cement is limestone and clay.

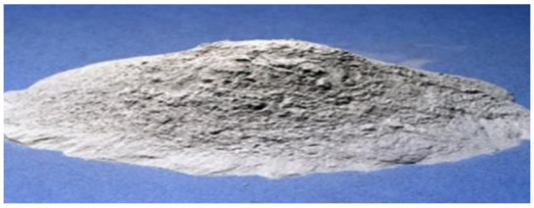


Fig. 2. Cement

2) Fine Aggregate

Sands are commonly used as fine aggregate. Sand may be either natural or artificial. The fine aggregate fills the voids present in coarse aggregate and minimizes shrinkage of concrete. The size of sand particles should be between 75 micron to 4.75mm.



Fig. 3..fine aggregates

3) Optical Fiber

An optical fiber is a flexible, transparent fiber made of extruded glass (silica) or plastic, slightly thicker than a human hair. It can function as a wave-guide, 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 fibers is known as fiber optics. Optical fibers are widely used in fiber-optic communications, where they permit transmission over longer distances and at higher bandwidths than wire cables. Fibers are used instead of metal wires because signals travel along them with less loss and are also immune to electromagnetic interference. Fibers are also 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 fibers are used for a variety of other applications, including sensors and fiber lasers.

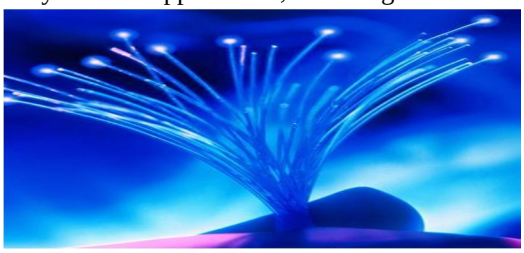


Fig. 4. Optical fibre

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 wave-guide.

4) Glass Powder

Glass powder is an extremely fine powder made from ground glass. It can be used in a number of industrial and craft applications and is often available through suppliers of glass and industrial supplies. High precision machining equipment is necessary to prepare it, as it needs to be very uniform, with an even consistency. Costs vary, depending on the level of grind and the applications. The process can involve dry or wet grinding to achieve particles of the desired size. Pigments can be added to make colored glass powders, and companies can also work with colored glass if they want to make powders of a particular color, like blue. The finished product can be hazardous and must be handled with care.



Fig. 5. Glass powder

5) Water

Water plays an important role in mixing of concrete. Water should be clean, fresh and free from-organic impurities. Reduction of water increase in strength of concrete and decreases work-ability. The ratio of minimum quantity of water required to the weight of the cement to obtain a desired concrete mix is called water cement ratio. The standard rate of water cement ratio is 0.45 to 0.55.

V. TRANSPARENT CONCRETE MIX PROPORTION

In transparent concrete 95% space is occupied by cement mortar, i.e. cement and sand. The remaining 5% is occupied by plastic optical fiber (POF). To increase the transparency of concrete cement is replaced by glass powder. Based on trial mix design the binding solution proportion will vary.

VI. SUMARY AND FUTURE WORK

Transparent concrete can be developed by adding optical fibre or large diameter glass fibre in the concrete mixture. The transparent concrete has good light guiding property and the ratio of optical fibre volume to concrete is proportion to transmission. The transparent concrete not looses the strength parameter when compared to regular concrete and also it has very vital property for the antithetical point of view. It can be used for the best architectural appearance of the building. Also used where the light cannot reach with appropriate intensity. This new kind of building material can integrate the concept of green energy saving with the usage self-sensing properties of functional materials. In the first phase I have completed the study of literature review, material collection and 1

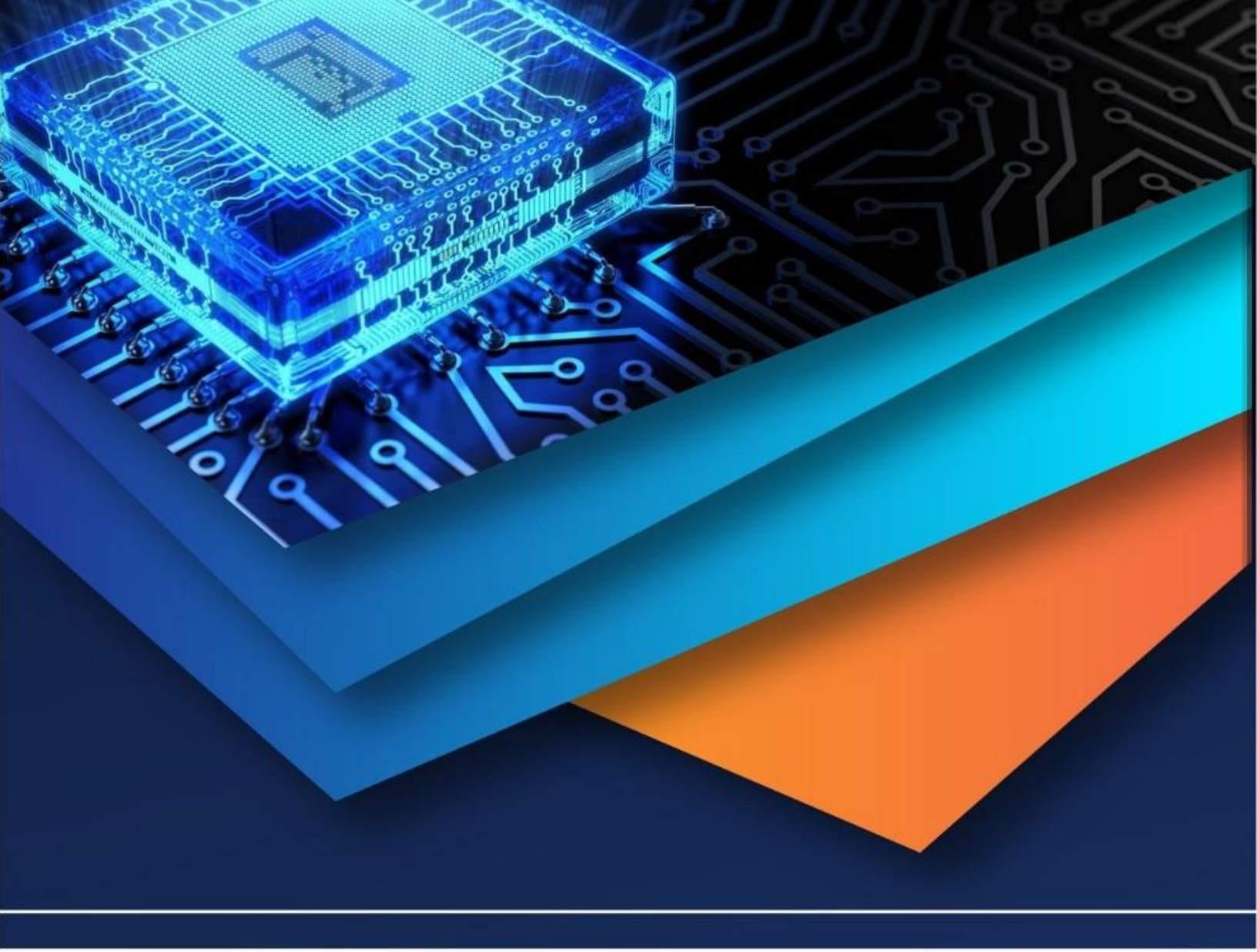
VII. CONCLUSION

1) Light transmitting concrete is an emerging trend in concrete technology.
2) Its initial cost is high but routine maintenance is not required and in long run it may be advantageous.
3) It is a green building material reducing the lightning cost during day time.
4) It is proved to provide both aesthetic appearance and structural stability.
5) In further its cost is expected to decrease.
6) It is one of the best applications of optical glass fibers which is related to technical textiles.

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