

# **An Overview of energy Efficiency of Translucent Concrete**

## **ABSTRACT**

*Due to globalization and the construction of high-rise building, the space between the building is reduced this causes the rising use of non-natural light, so it is significant to build up a new kind of building material. In this term paper based on excellent properties of light transmitting, an elegant translucent concrete is developed by arranging optical fiber into the concrete. As the optical fiber is sensing element, so it is worked on light theory. In the paper manufacturing, advantages, disadvantages, applications and future scope of translucent concrete is given. A few studies have been carried out on the translucent concrete with the replacement of usual concrete. This paper presents the current status and past studies in the area of translucent concrete. However, this new building material is in the development stage and it has a wide scope in future.*

**Keywords:** Translucent Concrete, Optic Fiber, Light Theory, Globalization,

## **1. INTRODUCTION**

There are various types of concrete for different application that are formed by changing the magnitude of the main ingredients. The mix proportion depends on the type of construction being built, how the concrete will be mixed and delivered. As civil structure are affects due to external environment, economic loss and casualties are damaged .Due to great economic growth, population growth, space utilized in all over the earth there is extreme changes in construction industry. Small buildings are replaced by elevated buildings and sky scrapers which arises problem of usual light in building due to obstacle of nearby structure. Due to this problem use of non-natural sources for lightning of building is increased by great amount. So need to reduce artificial light consumption in structure. Energy protection has an important issue in today's world. To mitigate usage of energy by buildings and future construction which will use less amount of energy has focused by many researchers. So Translucent concrete is single material which has ability to pass light through it.

Translucent concrete is made by optical fiber which light transmitting property. Aron Losonczy, first introduced the idea of light transmitting concrete in 2001, then produced the first translucent concrete block in 2003, named Litracon. In this paper the translucent concrete blocks are manufactured with the help of Optical Fibers. The main purpose to use natural light is to decrease the power consumption of illumination.

## **2. LITERATURE STUDY**

**A. Research & Development of plastic fiber based smart translucent concrete:** Zhi Zhou explained that energy saving & safety evaluation are two type issues for infrastructure of translucent concrete using plastic fiber & fiber bragg is discussed. The experimental result gives an optical fiber easily combined with concrete and that the plastic optical fiber could provide light transmitting ratio. Due to excellent light guiding and sensing advantage such as anti-electromagnetic intrusion capability, small size, scattered measurement, anti-corrosion characteristics optical fibers are used in communication and sensing fields.

**B. Transparent concrete As a green Material For Building:** Akshaya B Kamdi explained The manufacturing, uses and future scope of translucent concrete. The material used for manufacturing is optical fibers and well concrete. Traditional uses, emerging uses, environmental impact. Translucent concrete could be used almost where glass or traditional concrete is used is also explained in paper.

**C. Application Of Translucent concrete in construction World:** Ramesh Bajpai explained Translucent concrete produced from fine grained concrete & optical fiber which are laid in layer Optical fiber make to see light, shadow & colour so used for decorative purpose. The paper also gives the technical data, technical properties of translucent concrete which are tested in laboratory. It also gives the technical data used in translucent concrete that ingredients used are 96% concrete, 4% optical fibers, density:2100-2400 kg/, Compressive strength:50-70 N/

It also gives the applications of translucent concrete on front doors of homes as to allow the inhabitants to see when there is a person standing exterior

**D. Experimental study of Litracon:** S. Ravivarman explained the objectives of translucent concrete; The Litracon has strength of traditional concrete. he also explained the developed process of translucent concrete, Experimental investigation with respect to workability, compressive strength, flexural strength.

- E. An Experimental Investigation on Energy efficient light weight translucent concrete:** M.Sangeetha.V and their team explained the key advantages of light weight concrete as they are light in weight so reduce the dead load on structure so faster building rate in construction, handling cost, lower haulage. Optical fiber functions as wave guide. This decorative concrete can be used in interior building structure like beam, slab, walls , etc . The paper also gives the result regarding the workability by conducting slump cone test and observed slump is 90 mm, Weight of concrete cube, compressive strength, flexural strength and comparison of traditional concrete and translucent concrete.
- F. Closed translucent façade elements with switchable U-value-A novel option for energy management via the façade:** Thi bault Pflug explained to prevent overheating of well insulated building in summer facade elements with switchable U value are possible solution. The measurement of such of material show possible switching of more than 100% of U-value between the insulating and conducting state. as paper also conclude the impact of the translucency on the artificial lighting system.
- G. Experimental work on light transmitting concrete by using optical fiber:** A.B.Sawant,R.V.Jugdar, V.P.Choughle explained the power consumption, optical fiber, Light theory, Types of optical fibers, placing of optical fibers, payback period. The paper gives conclusion regarding the Transmission of light through light transmitting blocks as the transmission of light is increase with the increase in percentage of optical fiber. The intensity of light passing through the block is maximum at 13 P.M. The maximum intensity of light passing through the block for 1% of fiber is 219.8 lux at cube face. Outdoor light intensity ranges from 0 lux to 1193 lux in day time between 7.00 A.M to 7.00 P.M .The paper also gives the conclusion regarding cost.
- H. An Experimental study on light transmitting concrete:** P.M.Shanmugavadivu, V.Scinduja, T.Sarathivelan, C.V.Shudesa mithronn. Explained the material used, mix proportion, placing of optical fibers and casting of concrete, workability, compressive strength, flexural strength that is experimental characteristics of translucent concrete. Paper conclude the efficiency of application of optical fiber is studied by comparing the strength with the normal M20 grade concrete and test results proved that efficiency is more in all aspects. The decorative concrete can be used in interior design of building as panels in slabs, walls, and windows because it transmits the sunlight.
- I. Computational modeling of translucent concrete panels:** Aashish Ahuja, Khalid M.Mosalam, Tarek I. Zohdi explained lighting consumes a substantial amount of non natural energy, it is necessary to look alternative technology which depends on natural lightning. Paper also gives a geometrical ray tracing algorithms to simulate light transmission property of translucent concrete panels. Which conclude the tilt angle for panel transmits maximum amount of light all the considered tilt angles.
- J. To evaluate properties of translucent concrete/mortar and their panels:** Neha Nagdive, Shekhar Bhole explained the material used for the manufacturing of translucent concrete and also the manufacturing process for translucent concrete, light theory in optical fiber. The paper conclude the smart transparent concrete has good light guiding property. The optical fiber volume ratio is proportionate to transmission light guiding property. It transmits the same amount of light through the brick no matter how thick it is.

### **3.MATERIAL**

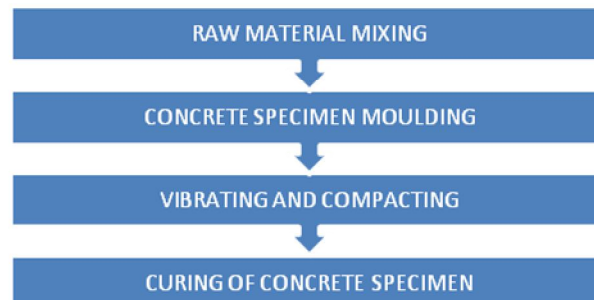
As we know that for making translucent concrete there are two basic materials one is from the construction region and other is from sensing region, The material used in study are cement, fine aggregate, aggregate dust, Optical Fiber and Water.

1. Cement: Generally selection criteria of cement are based on requirement of strength and durability of concrete. The type of cement used in this type of work is ordinary Portland cement of 53 -grade, has been IS: 12269-1987 certified. Grade-53 cement has the good quality and high durability. Generally used for huge structures like building foundations, bridges, tall buildings.
2. Fine Aggregates, Dust aggregate and Water: For the Litracon concrete block all normal concreting sands are suitable. Fine aggregate can be natural or manufactured; the fine aggregate used having the specific gravity of 2.65 and passing through 4.75mm sieve. Drinkable water is used for the proper workability and binding in translucent concrete. Normal river sand as fine aggregate and 10mm-20mm aggregate size will be used as coarse aggregate.

3. Optical Fiber: Fiber optic lines are thin strands of optically pure glass or plastic has the diameter is slightly thicker than human hair. Generally optical fibers are used to pass on the light at specific wavelength. As the optical fiber used in project is plastic optic fiber made up of plastic. Optical fibers are available in market.

#### **4. MANUFACTURING PROCESS**

The manufacturing process of translucent concrete is same as the conventional concrete only the optical fiber are spread all through the aggregate and cement mix. Light transmitting concrete is produced by adding the 4%-5% of optical fibers by volume into the concrete mix. Initially the fibers are arranged in required pattern previous to casting of concrete. The thickness of optical fiber is in between 2 $\mu$ m and 2mm which is suitable for requirement of light transmission. Smaller or thin layers permit a more quantity of light to pass through concrete.



#### **5. APPLICATIONS OF TRANSLUCENT CONCRETE**

In current stages the translucent concrete is not widely produced. They can only be produced as precast blocks and wall panels. It cannot be poured on site like the conventional concrete. Generally the translucent concrete is used for decorative purpose.

1. Translucent concrete blocks can be used as building material for external and internal wall.
2. For increasing visibility in dark subway stations.
3. Light transmitting concrete able to use in architectural construction sector for road.
4. This concrete can be used for ceilings of large administrative center building which reduce the lighting costs during daylight hours.
5. Sidewalks with translucent concrete could be illuminate which affect the safety and encourage foot travel which is avoided at night.

#### **6. ADVANTAGES AND DISADVANTAGES OF TRANSLUCENT CONCRETE**

##### **Advantages:**

1. As we know that natural sunlight is best source of light which is without cost.
2. Optical fiber work as heat insulator so the translucent concrete is suitable in cold countries.
3. Translucent concrete reduce the energy consumption so it save money.
4. It has high-quality architectural properties for giving the good aesthetical view to building.
5. The construction of building using the translucent concrete is totally environment friend.
6. As the initial cost is high routine maintenance is not required, So Advantageous in lengthy run

##### **Disadvantages:**

1. The translucent concrete is costly as compare to conventional concrete due to optical fibers.
2. For casting translucent concrete skilled workmen's are required.

#### **7. CONCLUSION**

- The translucent concrete has good lightning property.
- It has extremely good properties for aesthetical point of view. So give greatest architectural appearance to building.
- Translucent concrete can be used in areas where natural light cannot be reach with required intensity.
- It creates ecofriendly construction that reduces the energy consumption of project.

- The study until now was performed on translucent concrete specimens and predicting the strength and light transmittance properties of translucent concrete blocks. Many researchers tried the different percentage of optical fibers to achieve the strength and light transmittance property of the translucent concrete.

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