

# Preparation And Review Of Translucent Concrete

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*Abstract:-* Concrete, that traditionally solid, substantial building material, is getting a makeover. Engineers have currently developed concrete mixtures that are capable of transmittal lightweight. By change the ingredients of ancient concrete with clear ones, or embedding fibre optics, translucent concrete has become a reality. Light Transmitting concrete, also known as translucent concrete. It is the brightest artefact development in recent years. It is one among the most recent, most functional and revolutionary element in green construction material. In this the report 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.

Building energy saving and safe analysis for engineering structures have obtained the worldwide attention. It is a lot of importance for developing a brand new reasonably artefact, which can integrate green energy saving with self-sensing properties of functional material. In this paper, based on the excellent properties of light guiding and elastic-optic effect of optical fibres, a novel smart transparent concrete is researched by arranging the optical fibres into the concrete. To evaluate the effectiveness of the good clear concrete, light-weight the sunshine} guiding supported white light check, semi-permanent sturdiness supported temperature reduction and thawing check and chloride particle penetration test, and self-sensing property based on stress elastic-optic effect test are made respectively. The experiments results show that the sensible clear concrete has smart transparency, mechanical and self-sensing properties.

## 1. INTRODUCTION

Energy conservation has become an important issue in today's world. A study calculable that by 2050, the carbon discharged by business, institutional and residential buildings can quantity to 3800 tonnes and this carbon can consume thirty eighth of the world energy. To reduce the consumption of energy by buildings and the upcoming construction in future, development of a new construction material which will consume less amount of energy has attracted the attention of many researchers. Transparent concrete is one such material. Concrete is one among the foremost basic materials needed throughout every kind of construction. Transparent concrete is AN innovative concrete that has the power of belongings lightweight go through it.

Concrete encompasses a key role in development of infrastructure and housing. Due to nice economic process, population growth and space utilization worldwide, there is drastic change in construction technology. Small buildings are replaced by high rise buildings and sky scrapers. Thus arises one of the problem in deriving natural light in building, due to obstruction of nearby structures. Due to this drawback use of artificial sources for illumination of building is inflated by large amount. So it's terribly essential to scale back the substitute lightweight consumption in structure.

The concrete typically utilized in construction typically accommodates a minimum of cement water and aggregates (fine or course). As is known, traditional concrete has a greyish colour, and its high density prevents the passage of light through it, which means that it is also impossible to distinguish bodies, colours and shapes through it. As will be imaginary, concrete with the characteristic of being transparent will permit a better interaction between the construction and its environment, thereby creating ambiances that are better and more naturally lit, at the same time as significantly reducing the expenses of lying and maintenance of the concrete.

With the aim of eliminating these and different drawbacks, thought has been given to the development of a transparent concrete, which concerns a formulation of concrete which permits the passage of light through it, additionally works additional expeditiously within the mechanical sense than ancient concrete.

## 2. LITERATURE REVIEW

In 2001, the construct of clear concrete was initial hints by Hungarian creator **Aron Losonzi**, and therefore the initial clear concrete block was with success made by combination great deal of glass fibre into concrete in 2003, named as LiTraCon. Joel S. and Sergio O.G. developed a clear concrete material, which can allow 80% light through. There have additionally been inventions that apply this idea to a lot of technical applications like fissure detection. In the early 1990s forms like translucent concrete products which are popular today with fine & layered patterns were developed. Transparent concrete may be a concrete primarily based artefact with lightweight Tran-missive properties thanks to embedded lightweight optical components sometimes Optical fibres. Light is conducted through the stone from one finish to the opposite. Therefore the fibres ought to undergo the entire object. Transparent concrete is additionally referred to as the semi-transparent concrete and light-weight transmittal concrete due to its properties. The main purpose is to use daylight as a light-weight supply to scale back the ability consumption of illumination and to use the optical fiber to sense the strain of structures and additionally use this concrete as an subject purpose permanently enhance read of the building. The producing method of clear concrete is sort of same as regular concrete. Only optical fibres ar unfold throughout the the combination and cement mix. Small layers of the concrete ar poured on prime of every alternative and infused with the fibres and ar then connected. Thousands of strands of optical fibres ar forged into concrete to transmit lightweight, either natural or artificial. Light- transmittal concrete is created by adding four-dimensional to five optical fibres by volume into the concrete mixture. The concrete mixture is made from fine materials & it contains fine aggregate. Thickness of the optical fibres can be varied between 2  $\mu\text{m}$  to 2 mm to suit the particular requirements of light transmission.

**Zhi Zhou<sup>1,2</sup>, GeOu, Ying Hang, Genda Chen, Jinping Ou**, concluded that fibre bragged grating can be embedded in this smart transparent block to provide the block with functionality of self-sensing. He investigated to develop the building aesthetic in modern construction and consumption of energy with eco-friendly way. Fibre Bragged Grating arranged in concrete can sense the inner deformation concrete specimens under pressure and the changing tendency of the internal fibre grating. POF based mostly clear concrete might be considered associate art that might be employed in museums and specific exhibitions instead of simply a construction material.

**Er. Jadhav Sunil et al(April 2015)**, mentioned concerning the event of a lightweight transmission concrete exploitation plastic fiber, which is able to facilitate to scale back the consumption of electrical energy. They concluded the optical fibre used for transmission of light does not affect the reduction in strength of concrete. They conclude that the not loses the strength parameter when compared to regular concrete. The POF's have reduced the anti-permeability of the concrete. They achieved utilization & optimization of light and the resist induced effects i.e. electromagnetic effects. The sensible clear concrete may be considered a inexperienced energy saving construction material.

**Prof. R.V.Jugdar et al(2014)**, made Light Transmitting Concrete cubes of both Plastic Optical Fibre(POF) and Glass Optical fibre. He studied the excellent properties of light guiding, elastic optic effect of optical fibre. To evaluate the effectiveness of smart transparent concrete and they concluded the transparent concrete has good light guiding property and the POF volume ratio to concrete is proportion to transmission.

The result obtained from testing of conventional concrete and Optical Fibre concrete. The amount of POF's have seriously influenced the compressive strength of the corresponding concrete. The main purpose is to use sunlight as a light source, to make concrete partly transparent by using optical fibres in it to impart good appearance to structure, to study cost effectiveness of this high performance concrete.

**Patil Gaurav S., Patil Swapnil V. (April 2015)**, made light transmitting concrete using optical fibres and translucent stones. They studied the characteristics of light transmitting concrete. Also came to various advantages and disadvantages. They created conclusion as POF-based clear concrete might be considered associate art that might be employed in museums and specific exhibitions instead of simply a construction material. Although simple construction is to be compromised, the material is bound to be accepted universally due to its advantages. With the conception of inexperienced technology catching up, electrical supply, being supplemented by natural sources, it becomes absolutely necessary to utilize the natural resource. Although Litracon has nevertheless to be created on the market for industrial use, it has already been suggested that buildings made with the material could save electricity that would otherwise be required for daytime lighting. When light-weight transmission properties were examined, the check results have disclosed that the made concrete may be remove totally different shapes while not losing its clear property and it will

be used as subject concrete on roofs of special buildings. Moreover, this light-weight transmission concrete may be utilised within the production of special styles of home piece of furniture.

**Soumyajit Paul, Avik Dutta (Oct 2013)**, made a translucent concrete mixture comprising a mixture of polycarbonate and epoxy matrices as well as glass fibres, optical fibres, colloidal silica, silica and diethylentriamine (DETA) and Portland cement. This invention has bigger mechanical strength properties than those of a customary concrete, with lower density and mechanical characteristics that enable same to be used in both a structural and architectonic manner. The inventive formulation used to obtain the translucent concrete mixture comprises a type of concrete that is different from those currently available, which combines the advantages of existing concretes with translucency. A novel architectural material called translucent concrete can be developed by adding optical fibre or large diameter glass fibre in the concrete mixture. The translucent concrete has good light guiding property and the ratio of optical fibre volume to concrete is proportion to transmission. The semi-transparent concrete not loses the strength parameter when put next to regular concrete and conjointly it's terribly important property for the beautiful purpose of read. It may be used for the simplest subject look of the building. Also used wherever the sunshine cannot reach with applicable intensity. This new reasonably artifact will integrate the conception of inexperienced energy saving with the usage self-sensing properties of purposeful materials.

### 3. METHODOLOGY

#### 3.1 CONCRETE MIX DESIGN

**Mix Design-Grade of concrete M20 (IS 10262 - 2009 / IS 456 - 2000)**

#### 3.2 Target Mean Strength ( $f_{ck}$ )

- Target average 28 days compressive strength of concrete ( $f_{ck}$ )
- For tolerance (risk factor) =  $t = 1.65$
- Standard deviation =  $s = 5$
- $f_{ck} = f_{ck} + t*s = 20 + (1.65 \times 5) = 30 \text{ Mpa}$
- Maximum size aggregate = 10 mm
- Maximum water content = 208 kg
- For slump 50 mm, 208 kg
- For slump 100 mm, increase it by  $3+3=6\%$

#### 3.3 Selection of Water Cement Ratio

- Corresponding to this target mean strength and for OPC 53 grade of cement
- Table 5 IS 456, Maximum water cement ratio=0.45
- Based on experience, adopt water-cement ratio as = 0.45
- Least of above 2, finalize w/c ratio=0.45

#### 3.4 Calculation of Cement Quantity

- Cement quantity = water/wc = 488.8 kg/m<sup>3</sup>
- Approximately take as 500 kg/m<sup>3</sup>
- Vol of coarse agg to total agg = 0.44%
- Vol of fine agg = 0.56%



### 3.5 Calculation of Volume

1. Volume of concrete = 1 m<sup>3</sup>
2. Volume of Cement = 0.158 m<sup>3</sup>
3. Volume of water = 0.22 m<sup>3</sup>
4. Volume of chemical admixture = 0.004 m<sup>3</sup>
5. Volume of all in aggregate = 0.618 m<sup>3</sup>
6. Mass of coarse aggregate = 745 kg
7. Mass of fine aggregate = 948 kg
8. Aggregate/cement ratio = 4.4

## 4. CASTING

### STEP 1: PREPARATION OF MOULD:

Mould is prepared of size 150mm × 150mm × 150mm cube. The mould is made up of two metal faces with a metal base plate. The two faces of metal are drilled at a uniform spacing to hold the optical fibre in place during casting concrete into the mould. The two drilled metal faces are placed opposite to each other so as to place optical fibre in a single direction.

### STEP 2: PLACING OF FIBRES & POURING OF CONCRETE:



**Figure : Placing of Fibres in Layers**

The optical fibre are cut into sufficient length (250mm) and placed horizontally through the holes in the two metal sides facing opposite to each other. After placing of fibres, self-compacting concrete is poured layer by layer in the mould.



**Figure :After Compacting Back**

### **STEP 3: DEMOULDING:**

Once the concrete is cured for 24 hours, de-moulding is done.

### **STEP 4: TRIM THE FIBRES:**

After de-moulding the fibres are trimmed to the level of concrete block surface.

## **5. Conclusion**

The transparent concrete loses the strength parameter when compared to regular concrete. The transparent concrete has good light transmitting property and the ratio of optical fibre volume to concrete is proportion to transmission. It has very vital property for the aesthetical point of view. It may be used for the simplest beaux arts look of the building. Also used where the light cannot reach with appropriate intensity. The concrete have maximum compressive strength gain after 28 days at 1% fibre content, because the larger fibre content decrease the bonds between concrete but 7th day results is still not the indication for research work and 28th day results have to be taken into consideration. The light intensity goes on decreasing as distance increases beyond transmitting area.

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