

LIGHT TRANSMITTING CONCRETE

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Abstract - With the world looking towards better, beautiful, strong, energy saving building materials for a better future. Engineers all over the world are experimenting on different construction materials. This project here presents translucent concrete as a smart building material with increased strength, better looks and light transmitting features. This project also explains how it can be manufactured in various methods with the available materials. This project also discusses the experimentations performed like compression test etc., results and its comparison over the conventional building materials. With mass production and widespread marketplace acceptance we can assure it as a smart material for the future.

1 INTRODUCTION

Concrete has a vital role in development of infrastructure and living accommodation. High rise building and sky scrapers have replaced smaller buildings for space utilization due to population growth worldwide thus leading to develop new construction materials and technologies. Conventional building materials lack the ability of deriving natural light source into the living area which has increased the use of artificial sources for illumination of building by great amount. So it is very essential to reduce the use of artificial source of light in structure.

Our project of casting translucent concrete aims at reducing this operating energy by exploiting vast amount of potential energy in the form of sunlight. Another additional feature is its pleasing aesthetics that can change the picture of the concrete which is generally perceived as dull, pale, opaque greyness material. The main reason or purpose of the light transmitting concrete block is saving energy using natural light and making it as a green building material.

1.1 OBJECTIVE

In recent past concretes were considered a structural member only, but the concept of concrete has changed today. Innovative and smart building material like light transmitting concrete have come up in which concrete can be used as a decorative material. It can be observed that the concrete with light transmitting property shows increase in strength and also provides a pleasing appearance to concrete. Thus this project aims in making concrete stronger, attractive, energy efficient and eco-friendly green building material.

In fact, 50% day lighting is a mandatory requirement in a green building according to (IGBC) Indian Green Building Council. In coming future the light transmitting concrete would be more economical as the production cost of optical fibre will be minimised.

2 MATERIALS

- 1) Cement
- 2) Sand (passing through 4.75mm sieve size)
- 3) Water
- 4) Optical Fibre

2.1 OPTICAL FIBRE

Optical fibre is a transparent, flexible fibre slightly thicker than a human hair made of plastic or glass (silica).

2.2 LIGHT THEORY OF OPTICAL FIBRE

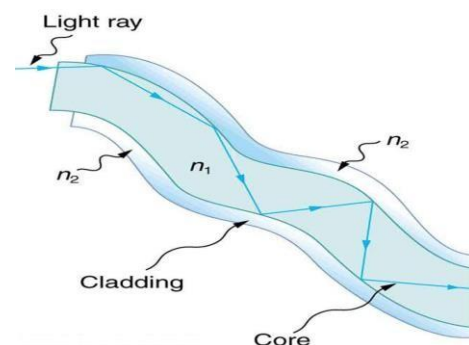


Fig1 Total Internal Reflection

The phenomenon in which a light ray travelling from a denser medium to a relatively rarer medium having an angle of incidence greater than critical angle will reflect back into the same medium, this principle is called as total internal reflection.

The optical fibre undergoes multiple internal reflections till the ray of light emerges out from the other end of the fibre. The bent in optical fibre has no effect on it.

3 METHODOLOGY



Fig2 Embedding optical fibre in formwork

In this method special formwork is to be made by drilling holes on any two opposite sides. Sides of formwork are then assembled on a base plate. The plate should be cleaned and oiled properly and then optical fibres are passed through the holes. Optical fibres are clamped on both the sides keeping the optical fibre in slight tension. Concrete mixture is then poured slowly into the formwork. During the process of casting concrete, the formwork is placed on vibrating machine in order to prevent air voids between optical fibre and concrete mixture, the concrete is now allowed to set for 24 hours and then formwork is removed and further curing process is carried out on the concrete block. Sides of the concrete block are polished for more aesthetical look.



Fig3 Casting of concrete block

3.1 DESIGN OF CUBE

Cubes are designed by Indian Standard recommended method of concrete (IS 10262 -1982)

DESIGN STIPULATION :

Grade designation	M20
Type of cement	OPC 53
Maximum Sieve size of aggregate	4.75mm
Max water-cement ratio	0.5
Workability	Good
Exposure condition	Mild

4 ADVANTAGES

- It has very good architectural properties for giving good aesthetical view to the building.
- Totally environment friendly because of it is light transmitting characteristic. And it is requirement for green buildings.
- Energy saving can be done by using transparent concrete in building.
- Blocks work as heat insulator which can be adopted in cold counties.

4.1 APPLICATION

- Light Transmitting Concrete can be used for interior and exterior walls.
- Facades, interior wall cladding and dividing walls based on thin panels.
- Increasing visibility in dark subway stations
- In furniture for the decorative and aesthetic purpose & Light sidewalks at night
- Lighting fixture & Transmitting concrete walls of restaurants, clubs, and other establishments to reveal how many Customers are inside.

4.2 FUTURE SCOPE

As every nation is looking towards better, strong, beautiful building materials and are facing problems of energy crisis. The translucent concrete seems to be the better and the optimal solution for the above said problems. Using translucent concrete helps us to save about 25% of electrical energy during days. Being better looking helps in reduction of plastering charges. As it is transparent helps in improving security as we can nearly see through them. Being strong means better strength, better load carrying capacity.

5 CONCLUSION

The Light Transmitting concrete do not loses strength parameter when compared to regular concrete. It 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 aesthetic 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. Optical fibre also acts as reinforcement for the concrete.

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Fig4 Light Transmitting Concrete