

An Overview on Transparent Concrete

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Abstract - In past various type of concrete was developed for construction work which are light in weight, self-compacted, having high strength but after the development of such concrete there are some problems also situated in the buildings that is darkness. In urban area where multistory building is situated very near to each other there is darkness in room in day time also. These problems can be solved by transparent concrete which transmit light through it. In day time it transmits sun light to room and at the night it gives good appearance of building. Transparent concrete pass light through it because of presence of optical fibers from outer face to inner face of concrete. Due to light gardening property of transparent concrete it makes energy efficient building.

1. INTRODUCTION

Transparent concrete or light transmitting or translucent concrete is a concrete which transmitting light through it by using optical fiber. It is material which makes green building. Conventional concrete made with the mixture of cement sand aggregate and water which is unable to transmit lights, transparent concrete is made with cement, very fine sand and thousand of optical fiber reinforced in concrete from one face to another face which guide the light passing through it. The first transparent concrete was mentioned in 1935 Canadian patent. The concept of transparent concrete was comes in 2001 which is introduced by Hungarian Architect, Aron Losoczi and the first transparent concrete block was successfully made in 2003 by using large amount of glass fiber and it is termed as LiTraCon. Due to development of glass and optical fiber works on transparent concrete will increases. Transparent concrete is not different from conventional concrete it have same material with addition of optical fiber. In many concrete fibers are used to increase the tensile properties of concrete but in transparent concrete optical fibers are not used for such purpose it transmit only lights.

2. LITERATURE REVIEW

Soumyajit Paul, Avik Dutta "Translucent Concrete", International Journal of Scientific and Research Publications, Volume 3, Issue 10, October 2013, ISSN 2250-3153 worked on transparent concrete with different percentage of optical fiber (1 to 6 %) and large diameter glass fiber. Analyze the light Guiding property of optical fiber and glass fiber and concluded that transparent concrete has good light Guiding property and the light transmission is directly proportional to the amount optical fiber.

Prof.Sonali, M.Kankriya "Translucent Concrete By using Optical fiber and Glass rods" International Journal of Scientific and Research Publications, Volume 6, Issue 10, October 2016, ISSN 2250-3153, Compare the Compressive strength of optical fiber reinforced transparent concrete and glass rod reinforced transparent concrete. Cost of optical fiber and glass rod reinforce concrete is also compare and concluded that the compressive strength of Transparent concrete is reduced to some amount and therefore it is applicable for mainly partition wall rather than structural element such as column and beam. The initial cost of transparent concrete is more as compared to conventional concrete but but due to continuous increase in tariff and payback calculation done, from the payback analysis it can be concluded that the saving of electricity bill is Rs.1368.58/- So the payback period for excess amount invested for light transmitting block will be 1.00 years for domestic consumption and 0.72 years for commercial and industrial consumption. The amount of carbon emission from transparent concrete is less.

Abhishek Tiwari, Parmod Saharan, "Study of Behavior of Translucent Concrete using Rice Husk and and Steel fiber" SSRG International Journal of Civil Engineering (SSRG-IJCE) – volume 3 Issue 7 – July 2016, worked on Transparent concrete with addition of Rice husk Ash and 0.125% of steel fiber. The percentage of optical fiber used in the paper varies from 0.25% to 4% and compare the compressive strength of concrete. It concluded that as the percentage of optical fiber is increased the compressive strength of concrete is decreased but by the addition of rice husk ash and steel fiber compressive strength of concrete is increased. The cost of transparent concrete is more but it is justified due to its various advantages such as energy saving property, aesthetically beautiful, sustainable etc.



Fig. – Transparent Concrete Cube

3. MATERIAL FOR TRANSPARENT COCNCRETE

- 1. Cement** – Transparent Concrete is generally used for transmit light therefore no special cement is require for it. Ordinary Portland cement of 43 grade can be used.
- 2. Sand** - Sand passing through 1.18mm size sieve should be used.
- 3. Water** - Water is used for mix all ingredient of concrete. For making transparent concrete portable water should be used.
- 4. Optical fiber** - An optical fiber or optical fiber is a flexible, transparent fiber made by drawing glass (silica) or plastic to a diameter slightly thicker than that of a human hair. Optical fibers are used most often as a means to transmit light between the two ends of the fiber and find wide usage in fiber-optic communications, where they permit transmission over longer distances and at higher bandwidths (data rates) than wire cables.

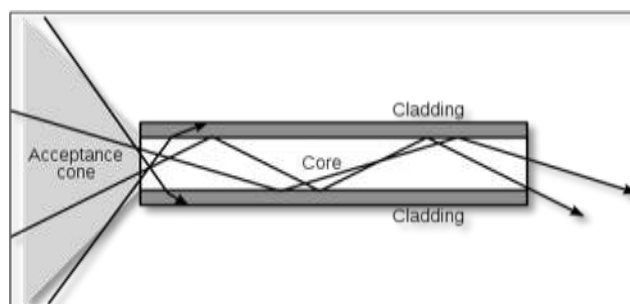


Fig. – Working Principle of Optical fiber

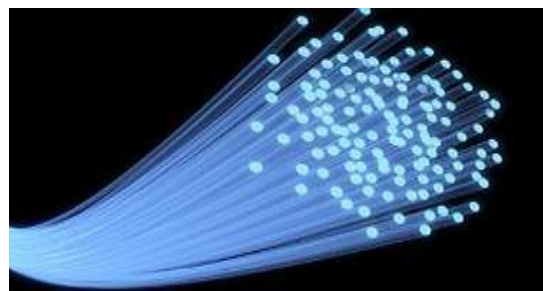


Fig. – Plastic optical fiber

4. WORKING PRINCIPLE

Transparent Concrete is based on “ Nano-Optics”, fibers are act as slit and carry light throughout. Thousand of optical fiber is reinforced from one face to another and transmit lights.

When light traveling in an optically dense medium hits a boundary at a steep angle (larger than the critical angle for the boundary), the light is completely reflected.

This is called total internal reflection. The process of total internal reflection is shown below. This effect is used in optical fibers to confine light in the core. Light travels through the fiber core, bouncing back and forth off the boundary between the core and cladding. Because the light must strike the boundary with an angle greater than the critical angle, only light that enters the fiber within a certain range of angles can travel down the fiber without leaking out. This range of angles is called the acceptance cone of the fiber. The size of this acceptance cone is a function of the refractive index difference between the fiber’s core and cladding.

5. ADVANTAGES OF TRANSPARENT CONCRETE-

1. According to principle of building planning the building must have good aesthetical view. Transparent concrete make it possible.
2. Where two building is very near to each other there are no lights inside the building, transparent concrete is beneficial for that place.
3. It emitted less amount of carbon.
4. It is Energy Saving.
5. It provides facility to see an image of person stands on outside of the door.

6. DISADVANTAGES OF TRANSPARENT CONCRETE -

1. The main Disadvantages of this concrete is excessive cost due to use of optical fiber.
2. It requires skilled labor for installation of optical fibers.

7. COMPARISION BETWEEN CONVENTIONAL AND TRANSPARENT CONCRETE -

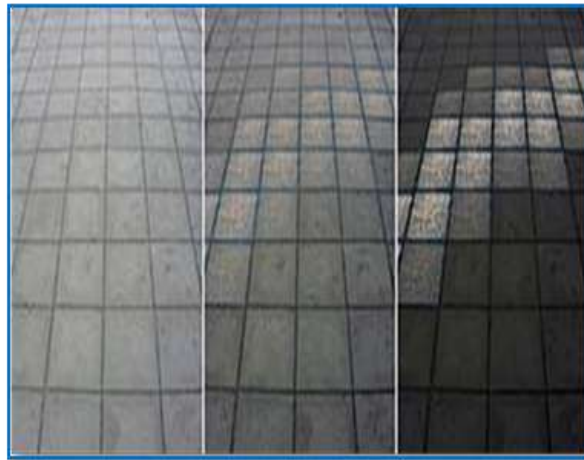
1. Transparent concrete is costly as compare to conventional concrete.
2. Good aesthetical appearance than conventional concrete.
3. Strength is almost similar to conventional concrete.

8. APPLICATION -

a) Illumination of wall -



b) Concrete Floor -



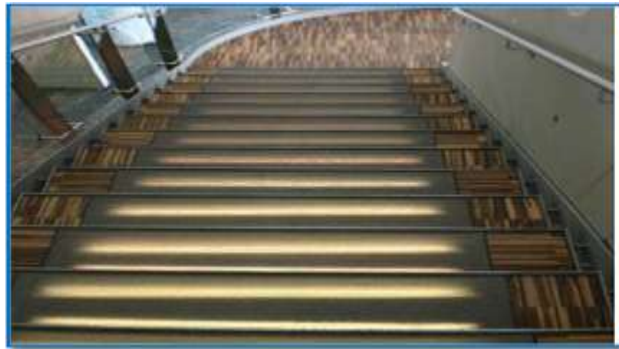
C) Reception Desk -



d) In Highways



e) In Stair Case



f) Concrete Panel



9. FEW EXAMPLES

a) European Gate -



The European Gate was built by Aron losonczy and Orsolya Vadasz in 2004 situated at Fortress Monostorin the Hungarian town of Komarom. It is made up with light transmitting concrete. The sun lights illuminate its wall at morning, afternoon. By using artificial light at night it give pleasant view.

b) Cella Septichora Visitor Centre



The main gate of Visitor center is made with transparent concrete blocks of 10cm thick. The blocks are arranged and fixed in a steel frame. The weight of the gate is 2 tons.

c) New Headquarters Of Bank Of Georgia



The wall of the headquarters of the bank of Georgia, Tbilisi, is made with LiTracon as shown above.

10. CONCLUSIONS

Transparent concrete is a good architectural material. As discussed in various papers, the strength of concrete is reduced by some amount, but it can be achieved by using some addition fiber, therefore the strength parameter of transparent concrete is the same as conventional concrete. Transparent concrete gives an aesthetical view to buildings. It is energy efficient and makes green buildings.

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