

International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: www.ijirset.com

Vol. 6, Issue 10, October 2017

A Study on Translucent Concrete and it's Properties

Er.Rohan.R.Vaswani ¹

Dept. of Civil Engineering, Guru Nanak College of Engineering and Technology Rashtrasant Tukdoji Maharaj
University Nagpur, India¹

ABSTRACT: Translucent concrete allow light to pass through it because of the presence of optical fibers within the opaque concrete wall. Light is transmitted from one surface of the said wall to the other, because of the presence of optical fiber strands along the width of the wall, which allows light to pass through. The principal objective of this project is to design translucent concrete blocks with the use of glass optical fibers, and then analyze their various properties and characteristics. All tests further performed on our concrete samples and on the optical fibers as such were done to ascertain the improvements of the casted blocks over normal concrete blocks of the same size and with the same design ratios, and to ascertain the practical utility of using translucent concrete as a building material for green building development

KEYWORDS : Translucent concrete, Optical fibres, Applications, Properties, Proportion.

I. INTRODUCTION

In 2001 by Hungarian architect Aron Losonczy was First invented the translucent concrete at the Technical University of Budapest by using optical fibres into the concrete. LITRACON is a first transparent concrete block produced in 2003 by using the optical fibres. Due to globalization and construction of high-rise building, the space between buildings is reduced; this causes to increasing the use of non- renewable energy sources, so therefore there is a need of smart construction technique like green building and indoor thermal system. Translucent concrete is new technique different from normal concrete. Translucent concrete allow more light and less weight compared to normal concrete. The use of sunlight source of light instead of using electrical energy is main purpose of translucent concrete, so as to reduce the load on non- renewable sources and result it into the energy saving. Optical fibres is a sensing or transmission element, so decrease the use of artificial light , the normal concrete is replaced by translucent concrete, which has natural lighting and art design. Light transparent concrete is produced by adding 5% optical fibres by total weight of cement into the concrete mixture. Translucent concrete element is going to be tested for other properties like compressive strength, NDT(Ultrasonic pulse velocity) Fig. 1 shows a typical sample of a Light transparent concrete through optical fibres.

International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: www.ijirset.com

Vol. 6, Issue 10, October 2017



Fig. 1. Light passing through translucent concrete using optical fibre.

II. MATERIALS AND PROCEDURE

1. Cement

The cement used in this experimental works is “Koromandal King 53 Grade Ordinary Portland Cement”. All properties of Cement are tested by referring IS 12269-1987 Specification for 53 Grade Ordinary Portland cement. The specific gravity of Cement was 3.14. The initial and final setting times were found as 51minutes and 546minutes respectively. Standard consistency of cement was 40%.

2. Fine aggregate:

Locally available sand passed through 4.75mm IS sieve was used. The specific gravity 2.75 and fineness modulus of 2.80 were used as fine aggregate. The loose and compacted bulk Density values of sand are 1600 and 1688 kg/m³ respectively, the water absorption of 1.1%.

3. Coarse aggregate:

Crush granite aggregate available from local sources has been used . The coarse aggregate with maximum size of 10mm having the specific gravity value of 2.6and fineness modulus of 5.60 were used as a coarse aggregate. The loose and compacted bulkdensity values of coarse aggregate are 1437 and 1556kg/m³ respectively, the water absorption of 0.4%.

4. Optical fibre elements:

Core - The thin glass center of the fibre where the light travels is called core.

Cladding - The outer optical material surrounding the core that reflects the light back into the core. To confinethe reflection in the core, the refractive index of the core must be greater than that of the cladding.

Buffer Coating – This is the Plastic coating that protects the fibre from damage and moisture.

CROSS-SECTION OF AN OPTICAL FIBER

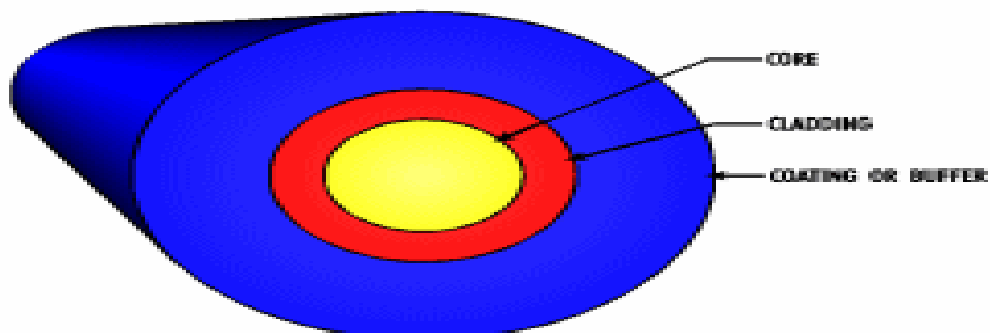


Fig.3 Fibre cross section

International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: www.ijirset.com

Vol. 6, Issue 10, October 2017

There are three basic types of optical fibres:

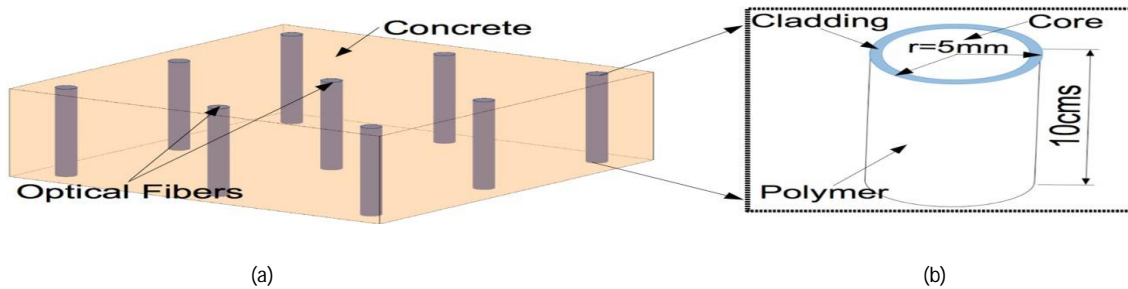
- [1] Multimode graded-index fibre.
- [2] Multimode step-index fibre.
- [3] Single-mode step-index fibres.

A Study on Translucent Concrete Product and Its Properties by Using Optical Fibres

III. PRINCIPAL OF OPERATION

Optical fibre is made up of three sections:

- 1) CORE –(carries light signals) thin glass center of fibre where light travels
- 2) CLADDING –(keeps light in the core) made of a material which has a lower refractive index than the core(for light to pass from the core out through the cladding, it would have to slow down). Instead, the light waves takes the path of least resistance by reflecting only in the core.
- 3) COATING –(protects the cladding) Plastic coating that protects the fibre from damage.



IV. MIXTURES AND PROPORTIONS

Cement	Sand	Coarse aggregate	Water
1	1.25	2.9	0.40

V. PROCEDURE

1. Making the mould

For making the mould roll some polymer clay into a circle and cut a plastic bowl from lower end to form a ring.

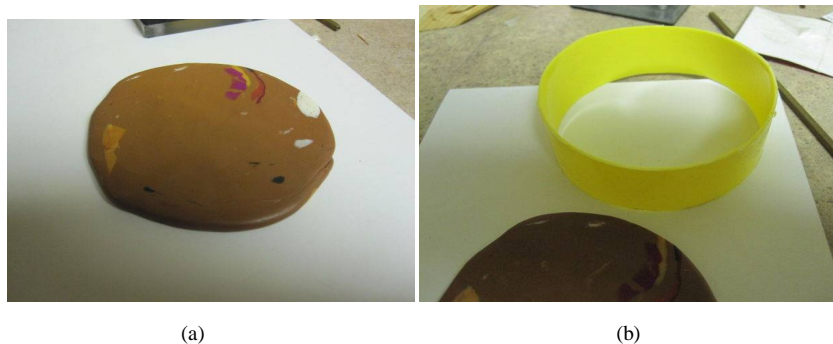


Fig 4. Making of mould by rolling clay or any other material so that we can embed fibres in it. Cut a ring time plastic bowl for mould.

International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: www.ijirset.com

Vol. 6, Issue 10, October 2017

2. Fibre optics

Cut a bunch of small 1 inch segments by breaking off about 10 wires from the bundle, and cutting them short in mass.

3. Placing the fibres

Stick the small fibreoptics you cut short (in the last step) into the polymer clay. This may take a while.

I used pliers. If you use them too, be mindful not to crush the fibres they are quite fragile, even though they are plastic.



Fig 5. The figure shows placing of fibres. Place the fibres carefully in order to avoid displacement of fibres.

4. Concreting

Pour the concrete and mix the concrete pretty thin because you don't want any air bubbles. Pour it carefully so that it does not affect the placing of fibres. Sometimes while pouring the fibres get displaced. Avoid displacements of fibres for the desired transparency



5. Breaking the mould and trimming of fibres

Once the concrete is cured two hours pull off the polymer clay and cut off the plastic ring. The concrete will not stick to the clay in fact, it's practically repelled by it.

International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: www.ijirset.com

Vol. 6, Issue 10, October 2017



6. Polishing

Use sandpaper to polish your new piece of light transmitting concrete. The effect is quite strange, sort of alien feeling. Even coloured light is able to pass right through and create a pixelated likeness on the opposite side.



Figure 6. Thoroughly polish the surface of the model by using sand paper so that it can produce a light transmitting effect.

VI. PROPERTIES

1. Technical specifications
 - Form: prefabricated blocks / panels
 - Components: Concrete, Optical fibre
 - Density: 2100 – 2400 kg/m³
 - Compressive strength varying
 - Bending Strength: 7.7 N/mm²

International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: www.ijirset.com

Vol. 6, Issue 10, October 2017

2. Material performance

- Concrete retains its strength
- High density top layer concrete
- Infused with optical fibres
- Frost and de-icing salt resistant.
- Fire protection.
- Highest UV resistance.

3. Environment Impact

- When a solid wall has the ability to transmit light, it means that one can use fewer lights during daylight hours.

VII. ADVANTAGES

- Less energy consumption.
- Illuminated Pavements.
- Homogeneous in structure.
- Finishing Surface.
- Routine maintenance not required.

VIII. DISADVANTAGES

- Very high cost about EUR 1300/m².
- Labours with technical skills are needed to manufacture it.
- It's a factory product.
- It is precision material and the correct procedure need to be followed. It is extremely important to ensure the integrity of optic strands if they break within the product property would almost be neglected.
- Costing of this material is difficult as the techniques are just start to develop.

IX. APPLICATIONS

Thanks to new features this material presents innovative technical solutions, semi-natural and ecological, for the traditional construction problems allowing a wide area of applications in construction, architecture, decoration and even furniture. Some of the possible applications for this new material are spread over several areas creating new possibilities to various products

Such as:

1. Translucent concrete blocks suitable for floors, pavements and load-bearing walls.
2. Facades, interior wall cladding and dividing walls based on thin panels.
3. Partitions wall and it can be used where the sunlight does not reach properly.
4. In furniture for the decorative and aesthetic purpose.
5. Light fixtures.
6. Light sidewalks at night.
7. Increasing visibility in dark subway stations.
8. Lighting indoor fire escapes in the event of a power failure.
9. Illuminating speed bumps on roadways at night.

International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: www.ijirset.com

Vol. 6, Issue 10, October 2017

X. CONCLUSIONS

A novel architectural material called translucent concrete can be developed by adding optical fiber or large diameter glass fiber in the concrete mixture. The translucent concrete has good light guiding property and the ratio of optical fiber volume to concrete is proportion to transmission. The translucent concrete not loses the strength parameter when compared to regular concrete and also it has very vital property for the aesthetical 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.

REFERENCES

- [1] ErJadhav sunil¹, ErKadlag amol², ErKawade chetan³, ErTalekarpravin⁴ Department of Civil Engineering Amrutvahini College of Engineering, A study on translucent concrete by using optical fibers IJMER Vol 5 Issue 4 2015 ISSN : 2249-6645
- [2] ErSomyajit Paul ¹ and ErAvika Dutta², Student of civil engineering in SRM University, Translucent concrete, IJSRP Vol3 Issue 10 P9 ISSN 2250-3153.
- [3] ErR Pradhipa¹ PG Student ¹ Dr S Krishnamoorthi² Head of Department ² Kongu Engineering college of engineering, experimental study on Translucent Concrete IJSRD Vol3 Issue 3 2015 ISSN:2321-0613
- [4] ErKavya S¹ Asst. Professor¹ Karthik D², Principal² Sivaraja M³, N.S.N college, An experimental study on Light Emitting Concrete M IJARET Vol3 Issue 2 2016 P188 ISSN:2394-2975
- [5] ErPatil Gourav¹, Assistant professor¹ in JSPM college of engineering Patil Swapnil ² Study on Light transmitting Concrete IJERGS Vol 3 Issue 2 Part 22015 ISSN:2091-2730