



Review on Transparent Concrete for Construction Industry

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ABSTRACT

This article discusses the use of translucent concrete and the benefits it offers in the field of smart construction, including the ability to reduce lighting power consumption, use optical fibre to detect structural stress, and use this concrete as an architectural feature for a pleasing aesthetic view of the building. By incorporating optical fibres into concrete, translucent concrete can have light-transmissive qualities. The fibre transmits light from one end to the other. Depending on the fibre structure, this causes a specific pattern of light to appear on the opposite surface. There is essentially no light loss when it is sent across optical fibres because of their efficiency. The difference between studies analysing the impact of employing various optical fibre ratios on the material strength and on energy-saving came to the conclusion that the ideal ratio of fibres should range between 4.3% and 6% for energy-saving, while the right ratio should be less than 5% for strength. In the conclusion, we make suggestions for recommendations to close these gaps in knowledge.

1. INTRODUCTION

The future construction of buildings as well as the energy usage of existing structures. The development of novel building materials with exceptionally low energy consumption caught the attention of many scientists and researchers. One such newly discovered material is transparent concrete. For all types of building, concrete is the fundamental component or substance needed. This unique transparent concrete is transparent and can allow light to pass through it. The optical plastic fibres in this novel concrete are strengthened, making it transparent. Transmitting light concrete is a novel substance that has numerous uses in the fields of construction, architecture, decorating, and even furniture. As one can assume, translucent concrete will allow for better interaction between the structure and its surroundings, resulting in richer and more naturally lighted ambiances while also drastically lowering the cost of placing and maintaining the concrete. The primary ingredients of translucent concrete are essentially identical to those of ordinary concrete, including cement, water, sand, and the absence of coarse aggregates, as well as a specified quantity of light-transmitting materials like plastic fibre and glass fibre. There are various ways to make transparent concrete, but "LiTraCon," which is made of 96% concrete and 4% by weight of optical fibres, is the most well-known brand. This essay seeks to examine the outstanding research on the uses, material characteristics, thermal and energy-saving, and light-transmitting qualities of translucent concrete. The paper discusses the discrepancy in the ratios of optical fibres in translucent concrete between researchers interested in studying compressive strength of translucent concrete and ones interested in studying energy saving because none of the reviewed studies achieve both maximum energy-saving and better mechanical properties.

2. LITERATURE REVIEW

R. Pradheepa (2015) "An Experimental Study on Translucent Concrete" Volume 3, Issue 3, Pg no 174-177. This paper deals with the usage of translucent concrete and also the advantages it brings in the field of smart construction, that it can reduce the power consumption of illumination and use the optical fiber can be made to sense the stress of structures and this concrete as an architectural purpose for good aesthetical view of the building. Translucent concrete is a concrete based material with light-transmissive properties, obtained by embedding optical fibers in it. Light is conducted through the fiber from one end to the other. This results into a certain light pattern on the other surface, depending on the fiber structure. Optical fibers transmit light so effectively that there is virtually no loss of light conducted through the fibres. This type of concrete can be installed at average cost of construction and increasing the visual appearance of the building. The work presented in this project reports an investigation on the behavior of concrete and mortar with optical fiber. Concrete and mortar cube are casted with fibers to study the properties and to compare the compressive strength between normal mix concrete with optical fiber and normal mortar with optical fiber after 7 days, 14 days and 28 days respectively.

SalmabanuLuhar (2017) "Compressive Strength of Translucent Concrete" Volume 8, Issue 2, Pg no 52-54. In this study, the compressive strength of translucent concrete was compared with that of conventional concrete to find out the potential of using translucent concrete for construction of green buildings. Translucent concrete was prepared by embedding plastic optical fibres in concrete. Concrete cubes of size 7cm x7cm x7cm were

prepared and POFs of diameter 1mm were embedded in it. Through the study, it was observed that the strength of light transmitting concrete was similar to that of conventional concrete and can transmit sunlight passing through it without any significant dissipation of energy, thereby saving energy of the building. It is prepared by embedding plastic optical fibres in concrete.

A. B. Sawant, et al (December 2014) “Light Transmitting Concrete by using Optical Fibre” Volume-3 Issue-1 Pg no 23-25. Small buildings are replaced by high rise buildings and sky scrapers. This arises one of the problem in deriving natural light in building, due to obstruction of nearby structures.

P.M.Shanmugavadivu (2014) “An Experimental Study On Light Transmitting Concrete” Volume 3, Issue 11, Pg no 160-163. Light transmitting concrete is one of the fibre reinforced concrete which is used for aesthetic application by incorporating the optical fibres in concrete. Optical fibres are one which helps for transmission of light through fibre. The end-lite type of fibre is used to increase the aesthetic appearance of the concrete. The concept of light transmitting concrete is like a transparent concrete. When it is used in ceiling or side wall, it is exposed to direct sun light which transmit the image but not completely transparent. The investigation is not constrained only with the decorative purpose but the effect of fibre application in the strength aspect is also discussed. When the fibres are arranged in different layers, that increases the load carrying capacity and also the patter can be created to make the concrete decorative. This type of concrete can be installed at a very low cost and increasing the visual appeal. The application can be used in decorating the interior of a hall or lobby and the ceiling to glow in dark by external lighting source and during day time the concrete glows by the light transmission from natural resource.

B.Yamininirmal, Mr. K.Nehemiya, Sri.G.Giriprasad(JULY 2017) “Study On Mechanical Properties On Light Transmitting Concrete” Volume 4, Issue 7, Pg no 1049-1055 . Rapid growth in population has led to dense building constructions with cement and concrete with large internal lightening requirement. To achieve energy efficiency, new and innovative materials are required for sustainable construction practices. This remains as a challenging task for engineers and other building professionals to design and promote low energy requirement buildings in a cost effective and environmentally responsive way.

3. Conclusion

- When compared to conventional concrete, light-transmitting concrete retains all of its strength properties. The optical fibre volume to concrete ratio is proportional to transmission, and it has good light transmitting properties.
- The smart transparent concrete is a potential technology for field applications in civil infrastructure and can be viewed as a "green" energy-saving building material. The compressive strength results obtained for the specimens with optical fibers was almost same as that of normal concrete specimen
- The main goal of this project is to create translucent concrete blocks using glass optical fibres, and then to examine their many features and traits.
- The smart translucent concrete has excellent mechanical, self-sensing, and transparency qualities.

REFERENCES

- [1] Development of plastic optical fiber based smart transparent concrete, presented at the Smart Sensor Phenomena, Technology, Networks, and Systems 2009, 2009. doi: 10.1117/12.816638.
- [2] K. M. Mosalam, N. Casquero-Modrego, J. Armengou, A. [2] Ahuja, T. I. Zohdi, and B. Huang, Anidolic day-light concentrator in structural building envelope, in Proc., 1st Annual Int. Conf. on Architecture and Civil Engineering, 2013: Global Science and Technology Forum (GSTF) Singapore.
- [3] K. Mosalam and N. Casquero-Modrego, Sunlight [3] permeability of translucent concrete panels as a building envelope, Journal of Architectural Engineering, vol. 24, no. 3, p. 04018015, 2018. doi:10.1061/61/(ASCE)AE.1943-5568.0000321.
- [4] M. N. V. P. Bhushan, D. Johnson, M. A. B. Pasha, and M. K. [4] Prasanthi, Optical fibers in the modeling of translucent concrete blocks, International Journal of Engineering Research and Applications (IJERA), vol. 3, no. 3, pp. 013-017, 2013. doi: 10.9790/9622.
- [5] A. G. Mainini, T. Poli, M. Zinzi, and S. Cangiano, Spectral [5] light transmission measure and radiance model validation of an innovative transparent concrete panel for façades, Energy Procedia, vol. 30, pp. 1184-1194, 2012. doi: 10.1016/j.egypro.2012.11.131.
- [6] B. Han, L. Zhang, and J. Ou, Smart and Multifunctional [6] Concrete Toward Sustainable Infrastructures. Springer Singapore, 2017, pp. XXV, 400.
- [7] A. Ahuja, K. M. Mosalam, and T. I. Zohdi, An illumination [7] model for translucent concrete using radiance, in 14th International Conference of the International Building Performance Simulation Association (IBPSA), Hyderabad, India, 2015, pp. 2586-2579.
- [8] R. Praveenkumar, S. Goumathy, K. M. Nomitha, A. R. A, [8] and S. Mathew, An Experimental Study on Smart Transparent Concrete, International Journal of Innovative Research in Science, Engineering and Technology, vol. 6, no. 3, 2017. doi: 10.15680/IJRSET.2017.0603158.
- [9] A. Dhonchak, A Glowing Future – Transparent Concrete, [9] International Journal Of Advance Research And Innovative Ideas In Education, vol. 2, no. 5, pp. 1465-1470, 2016. doi: 16.0415/IJARIIE-6254.

[10] A. Yadav, S. Shekhar, A. Anand, A. Badal, and B. Zaman, [10]An investigating study on a new innovative material: transparent concrete, International Journal of Engineering Research and Advanced Development, vol. 4, no. 1, 2018. doi: 10.25215/23955163.