IARJSET ISSN (O) 2393-8021, ISSN (P) 2394-1588

International Advanced Research Journal in Science, Engineering and Technology

ISO 3297:2007 Certified ⁜ Impact Factor 8.066 ⁜ Peer-reviewed / Refereed journal ⁜ Vol. 10, Issue 5, May 2023

DOI: 10.17148/IARJSET.2023.10524

A Review of Light Transmitting Concrete (LiTraCon)

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Abstract: The development and properties of light transmitting concrete (LiTraCon), which incorporates optical fibers into concrete for aesthetic and practical purposes. The papers explore various aspects of LiTraCon, including its production, strength characteristics, and potential applications in construction and design. The results show that the compressive strength of LiTraCon is similar to that of conventional concrete, and the transparency of concrete structures can be achieved with the insertion of optical fibers without compromising strength. Additionally, the use of eco-friendly materials in the production of LiTraCon has been explored, and smart transparent concrete has been developed for energy-saving and safety evaluation purposes. The studies suggest that LiTraCon is an emerging trend in concrete technology that offers future benefits in modern architecture.

Keywords: Aesthetic, Compressive strength, Energy saving, Light transmitting concrete, Optical fibers.

I. INTRODUCTION

Light transmitting concrete (LTC) is a new technology that allows light to pass through concrete structures, offering many benefits for modern architecture, such as reducing the need for artificial lighting and creating unique aesthetic effects. The research papers presented in this compilation explore the production, testing, and application of LTC, including the use of silica fume, glass rods, and eco-friendly materials. The studies also investigate the effects of fiber content, diameter, and orientation on the strength and light transmission properties of LTC, as well as its potential applications in construction, design, and safety evaluation. The results show that LTC can be both structurally efficient and decorative, offering promising future benefits for the construction industry.

II. LITERATURE REVIEW

The literature review paper related to study of LiTraCon was carried out, the main objective is to explore the production, testing, and application of LiTraCon without compromising in the compressive strength.

Zhi Zhou et al[1] The research paper presents the development of a smart transparent concrete using plastic optical fiber (POF) and Fiber Bragg Grating (FBG) for energy saving and safety evaluation in infrastructure. The POF provides steady light transmitting ratio and the FBG can be used as a sensing element for strain and temperature. The mechanical effects of introducing POF into concrete specimens were also studied. The smart transparent concrete can be used as a “green” energy saving construction material and as a smart intrinsic sensor for long-term Structural Health Monitoring (SHM). The study concludes that the smart transparent concrete has potential applications in the construction industry for energy saving and safety evaluation purposes. It can also be used for long-term SHM of structures, providing real-time data on the structural health of the infrastructure.

Yue Li et al[2] The use of light transmitting cement-based material (LTCM) made of optical fiber fabric and mortar. The study investigates the effects of fiber volume fraction on the material's strength and factors affecting its light transmittance. The study concludes that LTCM has good light transmitting properties, good mechanical properties, and is lightweight, making it a versatile decorative material. The microstructure of LTCM was analyzed using SEM, and the results showed that the matrix of LTCM is compact, and the optical fibers are embedded in the matrix evenly. The fracture

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section of PMMA fiber was circular and rough, and tiny gaps existed on the interfaces between optical fibers and cement matrix.

Huynh Phuong Nam et al[3] To develop a high-strength light transmitting concrete (LTC) using eco-friendly materials and a high content of optical fibers. The study conducted experiments to optimize the concrete mixture composition and investigate the effects of fiber content, diameter, and orientation on the strength and light transmission properties of the LTC. The results showed that the 80 MPa grade LTC with over 7% volume content of optical fibers and 50% replacement rate of eco-friendly raw materials of FA and GGBS was successfully developed. The light transmission ability of the concrete was affected by the orientation and spacing of the optical fibers, as well as exposure to warm temperatures. The study suggests that this type of concrete could be used in various applications where light transmission is required, such as in the walls and floors of buildings with natural lighting needs.

Poornima D et al[4] The production and testing of light transmitting concrete, which is a type of concrete that allows light to pass through it. The study compares the strength characteristics of light transmitting concrete with conventional concrete and investigates the effect of partial replacement of cement with silica fume. The results show that the compressive strength of light transmitting concrete is almost the same as that of conventional concrete, and the use of silica fume enhances the strength parameters of concrete. The study concludes that the insertion of optical fibers in concrete structures can introduce transparency without compromising strength, which is a step forward in modern architecture. The article suggests that light transmitting concrete is an emerging trend in concrete technology that offers future benefits.

Rakesh Kumar et al[5] This research paper discusses the use of light transmitting concrete, or Litracon, as a solution to the problem of limited natural light in buildings. The study aims to produce light transmitting concrete specimens by reinforcing optical fibers and comparing them with conventional concrete. The specimens were subjected to various tests, including compressive and split tensile strength tests, and the results showed that the transparency of concrete structures can be achieved with the insertion of optical fibers without compromising strength. The paper also includes a literature review and methodology for the study.

P.M.Shanmugavadivu et al[6] The use of light transmitting concrete, which incorporates optical fibers into concrete for aesthetic purposes. The study explores the effect of fiber application on the strength of the concrete and found that it can be used in interior design and can transmit sunlight, potentially replacing windows. The paper includes details on the materials used, mix proportions, workability, compressive strength, and flexural strength of the concrete. The authors conclude that the application of optical fiber can make the concrete both decorative and structurally efficient.

S.Ravivarman et al[7] The research paper discusses the development and properties of translucent concrete, which is made by adding optical fibers to the concrete mixture. The paper explains the manufacturing process, workability, and strength of the material, as well as its potential applications in construction and design. The main advantage of translucent concrete is its ability to transmit light, which can reduce the need for artificial lighting and create unique aesthetic effects. However, the material is also expensive and not widely available.

Prof A.A Momin[8] The study explores the use of glass rods and optical fibers to create light-transmitting concrete. The research found that the compressive strength of the concrete was similar to normal concrete, while the transparency of the concrete was higher with glass fibers compared to glass rods. The study concludes that light transmission is possible in concrete without affecting its strength.

Gurpreet Singh et al[9] The preparation of M25 grade concrete by using cement, fine aggregates, coarse aggregates and optical fibres. Here casting is done for both conventional concrete with 0% optic fibre content and other with 3 % and 4% of optic fibre. Light transmission test and compression test were conducted where the % of light transmission through 3% of optic fibre was 10.51 % and for 4% optic fibre it was 12.55%. This study concludes that as the % of optic fibre increases the transmission of light increases and also the compression strength strength of light transmitting concrete is slightly lesser than that of the conventional concrete.

M.N.V.Padma et al[10] The research paper discusses the use of optical fibers in translucent concrete blocks for energy-saving and smart construction purposes. The paper explains the construction process, advantages of using optical fibers, and various applications of translucent concrete blocks. The paper also mentions the cost and other properties of translucent concrete. The overall conclusion is that translucent concrete is a smart way of optimizing and utilizing light.

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Nandita Mohan et al[11] The use of foundry sand and optical fibers in translucent concrete. The study found that the addition of foundry sand can improve the properties of translucent concrete, with the optimum percentage being 30%. Optical fibers were also added to the mix, and treated fibers were found to improve bond strength without affecting light transmittance. The study suggests that replacing fine aggregate with foundry sand can modify concrete strength and the use of treated optical fibers can improve bond strength. Overall, this study provides valuable insights into the potential of using foundry sand and optical fibers in translucent concrete.

Rajesh R Naik et al[12] The characteristics of fibre reinforced transparent concrete with different percentages of galvanized iron (GI) fibres. The study examines compressive strength, flexural strength, light transmittance, water absorption, and sorptivity. The results show that the strength parameter of transparent concrete reaches a peak value at 1.5% addition of GI fibres. The addition of 1.5% GI fibers to transparent concrete increases its flexural strength by 55.56%, but decreases its workability. Water absorption and sorptivity decrease as the percentage of GI fibers increases. Light transmission percentage remains constant for all percentage additions of GI fibers. The higher compressive strength for GI fiber reinforced transparent concrete may be obtained by the addition of 1.5% GI fibers.

J.Maheswari et al[13] The research paper discusses the development of transparent concrete, a building material that allows light to pass through and aims to reduce energy consumption while providing an aesthetically pleasing option for architecture. The paper presents the materials used, such as cement and optical fibers, and the results from tests on compressive and flexural strength, as well as light transmission. The paper concludes that transparent concrete has comparable strength to traditional concrete and can be used for both decorative and structural purposes.

Anurag Wahane et al[14] The use of optical fibers in concrete to create translucent or light-transmitting concrete. The study analyzes the properties of concrete and mortar with optical fiber, and the light transmission of concrete samples made with different fiber amounts and thicknesses. The results show that the compressive strength of translucent concrete is similar to conventional concrete, and the light transmission is around 4%. The paper concludes that the use of optical fibers in concrete can lead to energy savings and green technology, and can be used in a variety of architectural and interior design applications.

III. CONCLUSION

The use of light transmitting concrete (LiTraCon), which incorporates optical fibers into concrete for aesthetic and functional purposes, has been the subject of numerous research papers. The studies have investigated the effects of fiber content, diameter, and orientation on the strength and light transmission properties of LiTraCon, and have shown that it is possible to create concrete that is both decorative and structurally efficient. The research concludes that LiTraCon can transmit light, potentially replacing windows and reducing the need for artificial lighting, and that it has potential applications in energy-saving and smart construction. Despite being more expensive and less widely available than conventional concrete, LiTraCon is an emerging trend in concrete technology that offers future benefits.

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REFERENCES

[1]. Zhi Zhou, Ge Ou, Ying Hang, Genda Chen, Jinping Ou, “Research and development of plastic optical fiber based smart transparent concrete”, Smart Sensor Phenomena, Technology, Networks, and Systems 2009, edited by Norbert G. Meyendorf, Kara J. Peters, Wolfgang Ecke, Proc. of SPIE Vol. 7293, 72930F.

[2]. Yue Li, Jiaqi Li, Yuhong Wan, Zhiyuan Xu, “Experimental study of light transmitting cement-based material (LTCM)”, Elsevior, 2015.

[3]. Huynh Phuong Nam, Nguyen Minh Hai, Nguyen Van Huong, Pham Duc Quang “Experimental study on 80 MPa grade light transmitting concrete with high content of optical fibers and eco-friendly raw materials” Elsevior, 2022.

[4]. Poornima D, Shailaja T, Pooja H P, Santosh G, Sachidananda B, Rashmi M P “An experimental study on light transmitting concrete”, Volume 6, Issue 5, IRJET, 2019.

[5]. Rakesh Kumar, Shubhada S, Jamadade “An investigational study on “Litracon””, Volume 10, Issue 8, IJRES, 2022.

[6]. P.M.Shanmugavadivu, V. Scinduja, T.Sarathivelan, C.V Shudesamithronn “An experimental study on light transmitting concrete”, eISSN: 2319-1163 pISSN: 2321-7308, IJRET 2014.

DOI: 10.17148/IARJSET.2023.10xx

[7]. S.Ravivarman, M.Mageswari, A.S.Kanagalakshmi "Experimental study of LiTraCon" , Volume 12, Issue 6 Ver. I PP 07-13, IOSR-JMCE, 2022.

[8]. Prof. A.A. Momin, Dr. R.B. Kadiranaikar, Mr.Vakeel.S. Jagirdar, Mr. Arshad Ahemed Inamdar "Study on Light Transmittance of Concrete Using Optical Fibers and Glass Rods" e-ISSN: 2278-1684, p-ISSN: 2320-334X, IOSR-JMCE (2014).

[9]. Gurpreet Singh, Dhande Uttam, Adurkar Ajit, Prof. Mrs Sayyed.G.A, "Experimental Investigation of LiTraCon by using Plastic Optical Fiber", ISSN: 2454-503, Volume 02, Issue 06, PP. 25-29, IJLRET, 2016.

[10]. M.N.V.Padma Bhushan, D.Johnson, Md. Afzal Basheer Pasha, Ms. K. Prasanthi, "Optical Fibres in the Modeling of Translucent Concrete Blocks", **ISSN: 2248-9622, Vol. 3, Issue 3, pp.013-017** IJERA, 2013.

[11]. Nandita Mohan, Aravind P V, "Investigation on Strength and Light Transmittance of Translucent concrete with and without Foundry Sand", Volume: 09, Issue: 03, IRJET, 2021.

[12]. Rajesh R Naik, Dr. K B Prakash, "An experimental investigation on fibre reinforced transparent concrete", Volume: 03, Issue: 08, IRJET, 2016.

[13]. J.Maheswari, T.Anush, V.Kiran, N.Nivetha, D.Praveen, "Light Transmitting Concrete", ISSN NO : 2319-9725, Volume 8, Issue IV, IJIRS, 2018

[14]. Anurag Wahane, Amitesh Kumar Sahu, Dikesh Jain, Reddy Shankar Rao, "Experimental Study on Translucent Concrete", Volume 10 Issue I Jan 2022, IJRASET, 2022.

