Experimental Study on Strength Characteristics of Pellucid Concrete and Conventional Concrete

S. Yeshwanthini[1], A. Priya[2], Mrs. N. M. Marry Treasa Shinu[3], Mr. S. Ragavendran[4]
[1, 2] Student, [3, 4] Assistant Professor,
Civil, Sri Muthukumaran Institute of Technology,
Chennai, India

***Abstract*- Energy efficient building and aesthetic views are the vital notes for infrastructure. Now engineers have developed smart translucent concrete using plastic optic fiber.Translucent concrete can transmit light from one phase to the other phase of the wall. Smart translucent concrete or transparent concrete is also known as pellucid concrete.The main advantage of replacing normal concrete with pellucid concrete is that it reduces the consumption of electricity by making use of natural sunlight.The present study involves the use of plastic fibers of 2mm diameter placed at 30mm spacing on two parallel sides of 150mm cube .The percentage of optical fiber used are in the range of 0%, 2.5%, 4.5%& 6.5% of the total weight concrete.The compressive strength of 2.5%, 4.5% & 6.5% of POF in pellucid concrete cubes are compared with conventional concrete.The project provides a new alternative to entrench the concept of sustainability and translucent concrete can be regarded as a green energy saving construction material.**

Keywords:- Pellucid Concrete, Smarttranslucent concrete (STC), Plastic Optical Fiber (POF). Compressive Strength.

INTRODUCTION

Translucent lightweight Concrete is a new material with various applications in the construction field, architecture, decoration and even furniture. As can be imagined, concrete with the characteristic of being translucent will permit a better interaction between the construction and its environment, thereby creating ambiences that are better and more naturally lit, at the same time as significantly reducing the expenses of laying and maintenance of the concrete.

Thousands of optical filaments are arranged side by side on a concrete base leaving the light to pass from one side to the other. Due to the small thickness of these filaments, they combine with the concrete. Compared with a traditional electric lighting system, illuminating the indoors with daylight also creates a more appealing and healthy environment for building occupants. It was a combination of optical fibers and fine concrete, combined in such a way that the material was both internally and externally homogeneous. It was manufactured in blocks and used primarily for decoration. Pellucid concrete presents the concept of light transmitting concrete in the form of a widely applicable new building material Civilization..The pellucid concrete was was first developed in 2001 by Hungarian architectAronLasancziat theparticular College of Budapest. Translucent cement can be precast squares of assorted measure. Inlight Pellucid concrete, which is usually known as direct concrete, Optical Fiber are projected intoconcrete.

PELLUCIDCONRETE

Pellucid concrete is also known as Translucent concrete abbreviated as TC. Translucent concrete almost consists of the same main components of traditional concrete such as cement, water, sand, and without coarse aggregates, besides, the specific amount of light transmitting elements as plastic fiber, and glass fiber. There are several ways to produce it, but the most popular trademark for translucent concrete material is “PELLUCID” which is made of concrete and 2.5% by weight of optical fibers.And by 4.5%

I. INGREDIENTS OF PELLUCIDCONCRETE

Pellucid concrete is composed of

- (53 grade ofOPC)
- Sand
- Water
- POF fibre

In the mix, coarse aggregates are deliberately not used because property of Pellucid Concrete is formation of micro cracks with large deflection. Coarse aggregates increases crack width which contradicts the property of Pellucid Concrete.

II. PROCEDUREFORMAKINGPELLUCIDCONCRETE MIXRATIO

Step 1: Placing of optical fiber as shown in . figure1.1&1.2

Step 2: Concreting is shown in fig. 1.3

Step 3: Cutting machine is used to cut the edges of fibers.

Step 4: The finishing is required for the smoothness of the surface. After all the above process finished concrete is looks like as shown in figure 1.4.

CASTING PROCEDURE OF PELLUCID -CONCRETE:

Very fine aggregate is mixed with Portland cement of 53grade.

The concrete mix is then placed in mould of required size.150mmx150mm

MixRatioOfMortar-1.0:3.0.

figure1.1 placing of fibre

fig.1.2. mould after placing of optical fibre.

Fig.1.3Casting of specimen

PLACING, COMPACTING & CASTING OF CONCRETE SPECIMEN.

Concreting: - In the present work the concrete mix has been prepared with ordinary Portland cement of 53 grade ,M sand 2.75mm sieve passing, coarse aggregates of 12mmdown size silica fume and tap water. The mouldswerecleaned thoroughly and oiled to obtain smooth finishing surface. The prepared mix and the layer of optical fibers were placed alternatively, and subject for vibrator machine or compaction.

Demoulding: - After 24hrs of casting demould the concrete specimens.

Curing of concrete: -After removing mould the concrete specimens were kept for curing for about 7days and 28 days.

Cutting and polishing: - After curing period of concrete specimens and before subjecting for tests, the extra portion of optical fibers projecting out of the cubes and cylinders has to be cut and polished for better transmission of light through the optical fibers.

TESTING ONCONCRETE

After curing process, the specimen has to be tested. Investigations are carried out by testing cubes, slabs for 7, 14 days only the curing process for 28 days still not completed. Cubes were tested oncompressivetesting machine and compressive strength of cubes with and without POF is compared.

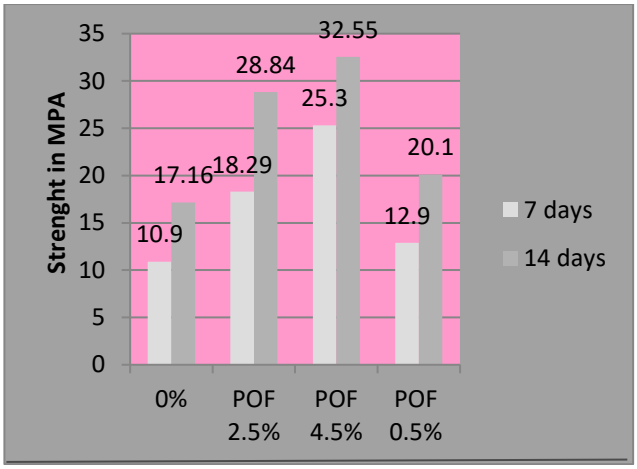
fig.1.4. Mould after remoulding

fig1.5curing

RESULTS:

Table Compressive strength results of presentexperimental work

SINO	Description		Averagecompressivestrengt hN/mm^2	
			7days	14days
01	ConventionalConcrete		10.9	17.16
02	Concretewith POF	2.5%	18.29	28.84
		4.5%	25.3	32.55
		6.5%	12.9	20.10



CONCLUSION:

- Itcanbeconcludedthatthecompressivestrengthofligh ttransmitting concrete with 2.5% of POF has increased by17.13%thanthatofconventional concrete for 14 days.
- Alsoitisobservedthatthecompressivestrengthofpell ucid concrete with 4.5% hasbeenincreasedby22.76%thanthatofconventionalco ncrete.
- From the above points it is clear that pellucid concrete with POF has increased its compressive strength when compared with conventional concrete
- Applicationofopticalfiberwillmaketheconcreteaest heticappearanceaswellaswe canmaketheconcretestructuralefficientbyactingasreinf orcingmaterial.
- Byusinglighttransmittingconcreteitacquiresminim um power consumption. Light transmitting is anemergingtrendinconcretetechnology.It'sconsidereda saspecialconcretewhichensuresfuturebenefits

REFERENCES

[1] AbhishekPratap Singh.(2018)TRANSLUCENT CONCRETE: A RESEARCH PAPER
[2] Amarkhail, N. (2015). EFFECTS OF SILICA FUME ON PROPERTIES OF HIGH-STRENGTH CONCRETE. International Journal
[3] B.RaghavaMaheedhar, V. Naresh. (2020). Mechanical Properties of Light Transmitting Concrete
[4] Concrete Technology Theory and practice, by M.S.SHETTY, S.CHAND
[5] Ghutke, V. S. &Bhandari, P.S. (2014). Influence of silicafume on concrete. IOSR Journal of Mechanical and CivilEngineering.
[6] Gurpreet Singh, DhandeUttam, AdurkarAjit, Prof.MrsG.A.Sayyed [2017] "EXPERIMENTAL INVESTIGATION ON LITRACON BY USING PLASTIC OPTICAL FIBRE", International Journal of Latest Research in Engineering and Technology (IJLRET).
[7] Martina Schnellenbach-Held and KarstenPfeffer,"Punching behavior of biaxial hollow slabs" Cement and Concrete Composites, Volume 24, Issue 6, Pages 551-556, December 2002.
[8] Nikhil k Ummer, farook nk.(2016)Experimental Analysis of Translucent Concrete by using Optical Fibers
[9] P.A.Subathra and S.P. Sangeetha.(2021). Performance of Pellucid Concrete by using Optical Fibers.
[10] Sasidharan. J, Naga Sai Teja. A (2017)Translucent Concrete
[11] Sergiu Cal in, CiprianAsavoaie and N. Florea, "Issues for achieving an experimental model" Bul. Inst. Polit. lai, t. LV (LIX), f. 3, 2009.
[12] SOUMYAJIT PAUL, AVIK DUTTA(2013) Translucent Concrete
[13] Tina Lai "Structural behavior of Transparent Concrete and their applications to lightweight bridge decks" , M. Tech thesis, MIT, 2009.
[14] Ts.Dr.Hj.UmarHj.Kassim.(2019)A Review of translucent concreteas a innovative material in archietecture.
[15] IS:1199-1959 Code of practice for "Workability of Concrete by Slump Test".
[16] IS:5161959 Code of practice for "Compressive Strength Test".
[17] IS:5816-1976 Code of practice for "Split Tensile Test.