International Journal of Advances in Mechanical and Civil Engineering, ISSN: 2394-2827 Volume-4, Issue-3, Jun.-2017
http://iraj.in

LIGHT WEIGHT TRANSLUCENT CONCRETE

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Abstract - Light Weight Translucent concrete is the concrete in which light is transferred through stone (concrete) from one end to other. This conduction of light takes place because of the material that is optical fibers which gives the transmissive property to the concrete block. Optical fibers are embedment in transverse, defined direction layer by layer according to the pattern required. Percentage of light and its pattern depends upon the fiber layout or structure. For making the structure lighter cavities are created by introducing voids in it. This void can be created by using FOAMING AGENT (EBBASOIC) and also light weight aggregate that is over burnt bricks. (Note: Size of the aggregate should not greater than 10mm in size).

I. INTRODUCTION

As in the developing world, problem related to environment and energy is escalated to great scale. Energy is required to perform any task at every stage. Therefore to maintain the sustainability along with the development it is important to develop the technology which reduces the Embodies or operation energy. Hence translucent concrete is casted to explore the vast potential energy that is sunlight. According to (IGBC) Indian Green Building Council 50% day lighting is a mandatory required for GREEN BUILDING accounting for 3 credits. Hence translucent concrete comes as a great blessing which gives better interaction between construction and environment.

For the structure design, the main load is considered as the dead load. And light weight concrete results in the reduce of weight of column, beam, foundation and all other load bearing elements [1]. With the possibility of producing a wide range of densities (400-1600) kg/m3 and also of achieving a strength of at least 25 MPa, foamed concrete has the potential to fulfil these requirements and it is now widely used in the construction industry [3], [4]. Furthermore, sustainability can be enhanced by using light weight translucent concrete.

II. MATERIAL

2.1. Concrete:

Ordinary Portland cement concrete of grade 43 is used for manufacturing the concrete block of size 15cmX15cmX15cm. In the concrete sand passing through 2.75 passing sieve and course aggregate as over burnt bricks graded less than 10mm size, superplasticizer as resin is chosen with the appropriate w/c ratio.

2.2 Plastic Optical Fibers(POFs):

POFs are the long cylindrical fibers which allows light to pass through them without significant loss of energy. POFs works on the principal of total internal reflection. The size of the optical varies from 200µ to 1 mm.

2.3 Coarse Aggregate:

Coarse Aggregate is taken grading less then 10mm in size. Coarse aggregate is also chose as a over burnt bricks which is having specific gravity as 1.9 less then natural aggregate.

2.4 Superplasticizer:

For water reduction in the concrete resin as a superplastizer is chose, which is High-range Water-reducer SM (Sulfonated Melamine-formaldehyde Resin) (polymer electrolyte), SM is the best one of existing concrete admixture in comprehensive properties.[2]

Table 1

Sl.no	Material	Specification
1.	Cement	OPC43 Grade
2.	Coarse Aggregate	Over burnt bricks less than 10mm
3.	Fine Aggregate	Pass from 2.36
4.	w/c ratio	0.45
5.	Superplastizer	Resin
6.	Optical Fiber	200µ-1mm

III. MOULD AND SPECIMEN FABRICATION

For casting of translucent concrete there is required to construct different type of mould. Mould is prepared in which base and two side is of wooden surface and other surface is made up of PCB(printed circuit board) of size 15X15. PCB is chosen because it has defined holes in which optical fibers can be laid out in transverse direction. Perforated board rest on plywood base. Optical fiber are laid or batched by volume, placed through the holes individually.

IV. EXPERIMENT PROGRAM:

4.1 Compressive Strength

Eight of cubes were casted, among which two of them are control concrete (C11, C12), three of them are of translucent concrete (C21, C22, C23) having

percentage of optical fiber are varies from 3%, 4% and 5% and rest three cubes are made up of light weight translucent concrete (C31,C32,C33) with the same optical fiber as 3%, 4% and 5% additional foaming agent plus light weight aggregate for making concrete more lighter. Before filling the concrete perforated wooden mould is firstly coated with the oil so that concrete would not show adhere with the mould.

And then compressive strength of cube is found out by using compressive strength machine.

4.2 Light Transmittance Test on Specimen:

The Light transmittance of the concrete is measured by the amount of light energy passing the concrete block. An box is made in which permanent source of light 100W is placed at the top and by using the photo diode or LDR (Light Depending Diode) which is placed at the lower surface of the box, measures the amount of light energy received through it. PCB are soldered onto PCB board as shown in fig.

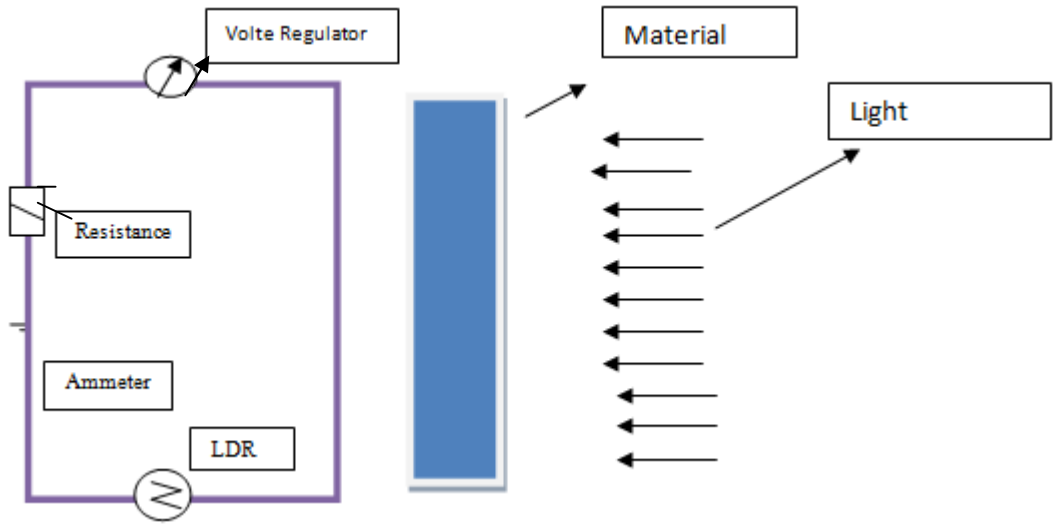


Fig (a)
Fig(a) shows the circuit layout for measuring the light

Fig (b)

Fig(c)

Fig (b) and (c) shows the layout of optical fiber in the mould and casting of optical fiber.

4.2 Light Weight Agents:

4.2.1 Light weight can be achieved by using the Chemical EABASSOC which is used to generate foam. EABASSOC Foaming Agent is a highly concentrated, highly efficient, LOW DOSAGE liquid. When processed through a foam generator a solution of EABASSOC Foaming Agent in water creates a stiff, white foam with a 20 to 25 times increase in volume and NO foam collapse. The foam can easily be incorporated into any mortar mix to make EABASSOC Lightweight Foamed Concrete, even when using cold water. And its having the pH 6.7, Specific gravity 1.02 with the dosage rate of 0.3 to 0.6 lit per meter cube[10]

4.2.2 Over burnt brick (OBB) is used by replacing as natural aggregate. OBB is having the specific gravity much lesser than the natural aggregate that is 1.9. Also water absorption of OBB is 7.1 and crushing value of 36.2.

V. RESULTS

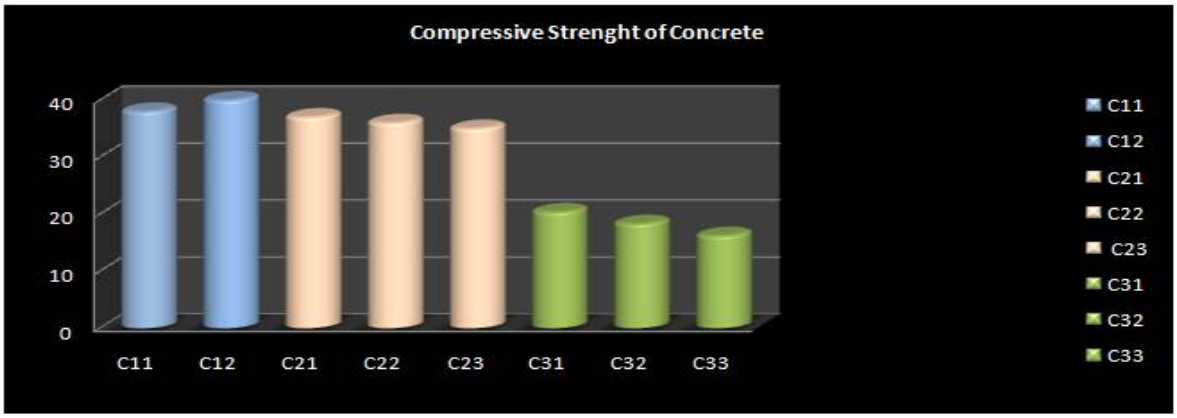
5.1 For Compressive Strength:

Compressive strength of concrete is measured by using compressive testing machine. It is absorbed that

the compressive strength of concrete is in the control specimen i: e. 39KN/mm^2 and the compressive strength of concrete with optical fiber is 36KN/mm^2 as the percentage of optical fiber increase the compressive strength slightly decreases. But in case of light weight translucent concrete it is absorbed that the compressive strength decreases to high scale. Its compressive strength is found to be 21.26 KN/mm^2.

Therefore from the results of compressive strength it can be concluded that in the translucent concrete while inducing optical fibers, the strength is not effectively affecting. But light affects the strength.

Graph 2



5.2 Test results for light transmission:

Table 2

Sample		Optical Fiber Specimen			Light Weight Optical Fiber Specimen		
Percentage of optical fiber		C23	C22	C21	C33	C32	C31
		5% of POFs	4% of POFs	3% of POFs	5% of POFs	4% of POFs	3% of POFs
Ammeter Reading	Without Sample(A1)	14.42	14.42	14.42	14.42	14.42	14.42
	With Sample(A2)	1.69	1.35	1.26	1.75	1.46	1.26
Light Transmittance 100 –(A1−A2)/ A1 X100		11.719	9.361	8.737	12.14	10.13	8.73

LDR measures the light transmissive is measured by LDR , LDR converts the light energy into current and the offered resistance is measured through it. For measuring an light source of 100W, an resistance 100 Ω bulb and uniform DC voltage of 2.5 V is kept between the circuit. Reading in the ammeter is taken firstly by taken without sample in the box. And secondly by keeping the sample in the box. Maximum percentage of light which passes through the sample is C1 and C2 is 11.71. But percentage can be increased by increasing the volume percentage of optical fiber.

5.3 Light Weight Concrete:

Graph 2

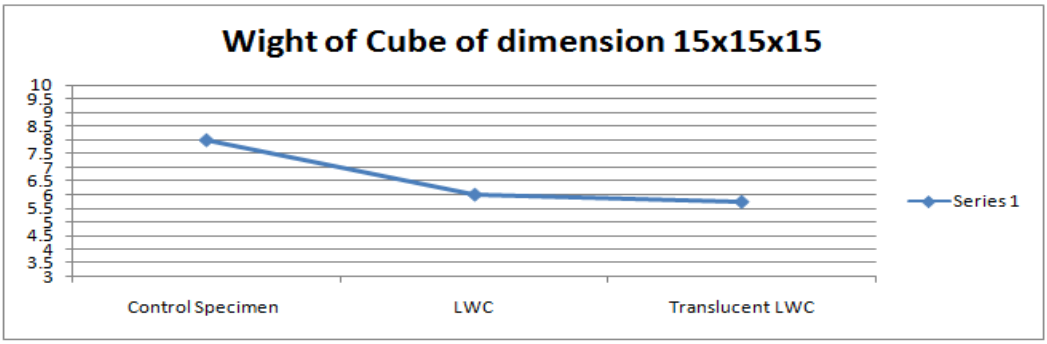


Table3. Wight of Cube of dimension15x15x15

C(00)	Control Specimen(C10)	LWC(C20)	Translucent LWC(C30)
1	7.9	6	5.7
2	8.1	6.1	5.8
3	Nil	5.95	5.81

Table 3

By using EABASSOC and OBB density of the concrete can be decreased by from 2106.67 kg/m^3 to 1802.37 kg/m^3.

VI. USAGE OF OPTICAL TRANSLUCENT CONCRETE BLOCKS

Translucent concrete can be used for different pursues in different area.

- It can be used in tunnels or in the dark subway station
- It can be used for the speed bumps, lane marking in highways. Its reflection can be used for navigation.
- It can be used in the wall of restaurants, clubs and other buildings
- It can be used for the security purpose.
- It can be used for decorative and aesthetic purpose.

Along with all these it can also be used in many more areas.

CONCLUSION

Translucent concrete is an novel architectural material. The translucent concrete has good light guiding property and the ratio of optical fiber volume to concrete is proportion to transmission. Compressive strength is studied for light weight translucent concrete and it is found that the strength decrease up to 34% to 40% for light weight translucent concrete. But for translucent concrete the strength slightly decreases about 2% to 3% when compared with the regular concrete.

This new kind of building material can integrate the concept of green energy saving with the usage self-sensing properties of functional materials.

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