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Light Transmitting Concrete Using Waste L.D.P.E.Pipe Filled With Statue Grade Casting Resin

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ABSTRACT: Translucent concrete made with statue grade clear casting resins filled into a duct of waste LDPE pipe which is utilized into concrete this imparts total internal reflection up to a satisfactory level and helps to utilize solar illumination to interior of a structure. Casting resins are much cheaper and easily available construction product which have a higher strength to weight ratio thus helps to reduce a lot of dead weight without compromising the strength of the structure. To achieve an clear transparent highly efficient light transmitting concrete by utilizing renewable solar light various tests are conducted over M20 standard grade concrete mix prepared as 1:1.5:3 proportions of Cement: Sand: Aggregate respectively along with 1:1 of statue grade clear casting resins: hardener casted in waste LDPE pipe pieces to get such transparent nature of concrete by total light transmission phenomenon with little loss and economy casting of the mix in multiple moulds of standard cubical size is done to test various properties such as strength (Compressive, tensile, flexural), light transmission as per IS-456 and IS-3370..

KEYWORDS: Light Transmitting Concrete; LDPE (Low Density Polyethylene) Pipe; Statue Grade clear cast resin; Hardener; Standard Mould, OFC.

I. INTRODUCTION

21st century is the era of Construction due to boom in demand to meet that industries adopt concrete as a construction material because of its versatile properties and it became a major construction material but it is opaque in nature thus obstructing sunlight to pass through thus to lightening up interiors of a concrete structures we have to pay a lot of money on electricity bill and emit a lot of CO₂s in electricity production. An average size residential room uses one bulb for lighting room of 100W and consumes about 24kWH per month so cost on one bulb in very loose sense is around 200 INR per month. The cost is not just that much actually it is much more than that as per CNFC data we emit 0.94Kg of CO₂ on production of each 1kWH electricity. This will create a domino effect over the climate as well that cost must be encountered in calculation of lighting a room as well. Since Sun provides ambient amount of energy to the earth in the form of solar radiation which is a primary source of energy to the earth. As per Wikipedia data Sun provides 127000 lumen/m² area thus If we are able to tap this energy this will revolutionize the construction industry. Numerous researchers already made various efforts to make concrete transparent nature like Optical fibre cable (OFC), translucent materials and many more but the best results obtained till now was with the use of OFC which is costlier and causes ample number of difficulties in construction. All these problems are overcome with the help of using statue grade clear cast resins casted in waste LDPE pipe to transmit light without any loss in strength of concrete not only it helps in making strong and but also durable concrete.

II. SIGNIFICANCE OF PROJECT

1. To tap renewable solar radiation of sunlight for illumination of the interiors of a concrete structure.
2. To ensure dead load over the structure by using cast grade resin for light transmitting element in concrete.
3. To save electrical energy that will lead to reduction in CO₂ emission.
4. To make economic and environment friendly construction.
5. To make aesthetical and pleasing structures.
6. To save electrical energy that will lead to reduction in CO₂ emission

III. MATERIALS

For the manufacturing of light transmitting concrete using statue grade clear cast resin casted in waste LDPE pipe following raw materials are used to ensure quality of materials that are used numerous tests are conducted over them as per I.S. code guidelines are listed below with their required and obtained results.

3.1. CEMENT

It is the main binding material for the concrete of 53 grade the test results obtained over it are as follows.

S. No.	Test name	Observed average value	Expected value
1	Fineness modulus	2.1%	$\leq 5\%$
2	Specific gravity	3.12	$\cong 3.15$
3	Normal consistency	30.1%	25 to 38 %
4	Soundness	2.0 mm	$\leq 10 \text{ mm}$
5	Initial setting time	39 min	$\geq 30 \text{ min}$
6	Final setting time	573 min	$\leq 600 \text{ min}$
7	Compressive strength	3 rd day	13.9
		7 th day	23.8
		14 th day	35.5
		28 th day	53.9
			$\geq 53 \text{ N/mm}^2$

3.2. AGGREGATE

It is chemically inert material used for matrix of the concrete following are the observations made on them

3.2.1. COARSE AGGREGATE

S. No.	Property	Observed average value	Expected value
1	Specific gravity	2.63	$\cong 2.6 \text{ to } 2.7$
2	Fineness modulus	7.3	$\cong 6.5 \text{ to } 8.5$
3	Water absorption	2.60 %	$\leq 6\%$
4	Flakiness index (F.I.)	0.89%	$\leq 10 \text{ to } 15\%$
5	Elongation index (E.I.)	2.0%	4 to 5 times of F.I.

3.2.2. FINE AGGREGATE

S. No.	Property	Observed average value	Expected value
1	Specific gravity	2.69	$\cong 2.6 \text{ to } 2.7$
2	Fineness modulus	3.0	$\cong 2.2 \text{ to } 3.2$
3	Silt content	1.17 %	$\leq 6\%$
4	Bulking of sand	1.75	---

3.3. Water

Water plays a major role for hydration of cement and in formation in cement gel which binds the matrix and plays major role in chemical reaction thus its property is checked and test results that are obtained are as follows.

S. No.	Property	Observed average value	Expected value
1	pH value	7.1	6.5 to 7.5
2	Organic content	0.0 ppm	$\leq 200 \text{ ppm}$
3	Inorganic content	250 ppm	$\leq 3000 \text{ ppm}$
4	Sulphate content	0.0 ppm	$\leq 400 \text{ ppm}$
5	Total suspended matter	250 ppm	$\leq 2000 \text{ ppm}$

3.3. Statue grade clear casting resin

This is the main component of the concrete utilized for light transmission through it due to physically transparent in nature after hardening it and possesses following mechanical and other specification labeled on the product are as follows.



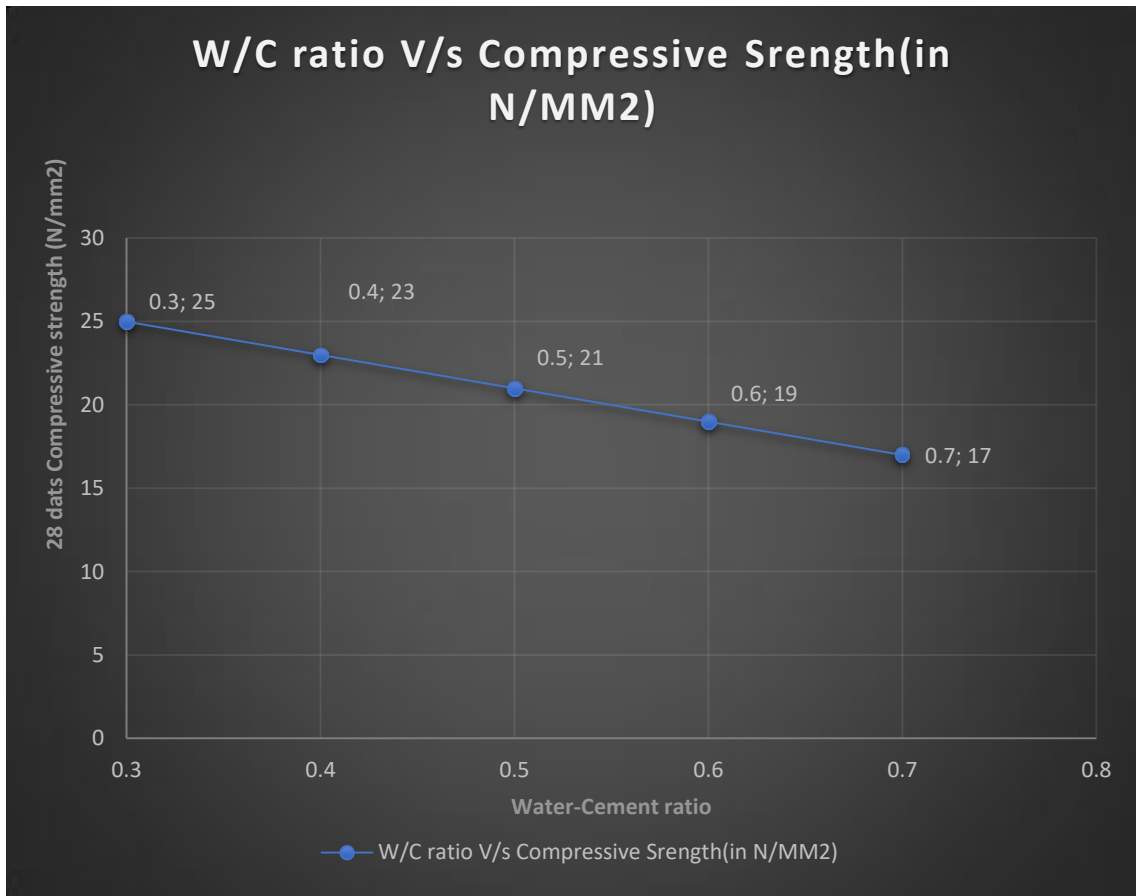
S. No.	Property	ASTM Test method	Results in Psi	Results in MPa
1	Flexural strength	D-790	13,200	85
2	Flexural modulus	D-790	7.32 x 105	5048
3	Tensile strength	D-638	6,400	44
4	Tensile modulus	D-638	7.17 x 105	4945
5	Tensile elongation, %	D-638	1.5	1.5
6	Heat distortion temperature	D-648	115 °F / 46.1 °C	
7	Hardness, barcol 934-1	D-2583	38 – 42	

S. No.	TYPICAL RESIN PROPERTIES @ 77°F RESULTS	
1	Catalyst %	1.0
2	Gel Time, (min.: sec.)	14:00 – 25:00
3	Gel to Peak Time, (min.: sec.)	35:00 – 60:00
4	Refractive Index	1.52

IV. MANUFACTURING PROCESS

Statue cast grade Resin and hardener are mixed in 2:1 proportion and casted in waste LDPE PVC pipes after completion of hardening period of statue grade resin the assembly of the above casting are placed in concrete moulds accordingly after the placing of M20 grade concrete is prepared in proportion of 1:1.5:3 and it is poured in the mould in three layers each layer is compacted by standard tamping rod by twenty-five times. The completion of curing period various tastings is done as per IS code and obtained test results are as follows. There are few more taste is done over concrete in green state of concrete as per IS code of conduct and average values of test results are shown below.

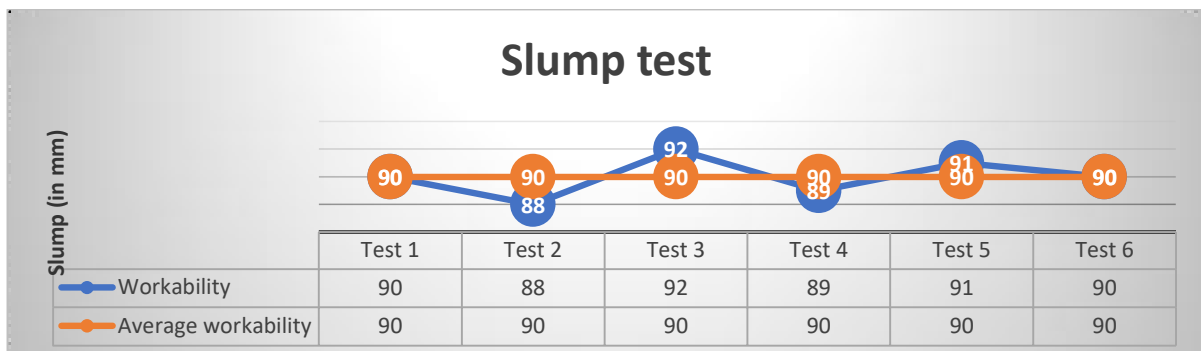
S. No.	Property	Observed value	Compressive strength (N/mm ²)
1	WATER CEMENT RATIO	0.50	21.00



(a)

Fig.1.Graph (a) W/C ratio Vs. compressive strength of standard size cube

S. No.	Property	Observed average value	Description
1	W/C ratio	0.5	---
2	workability	Slump test data	90 mm
		Compaction factor test data	0.90
3	Density	22.546 KN/m ³	Light weight concrete

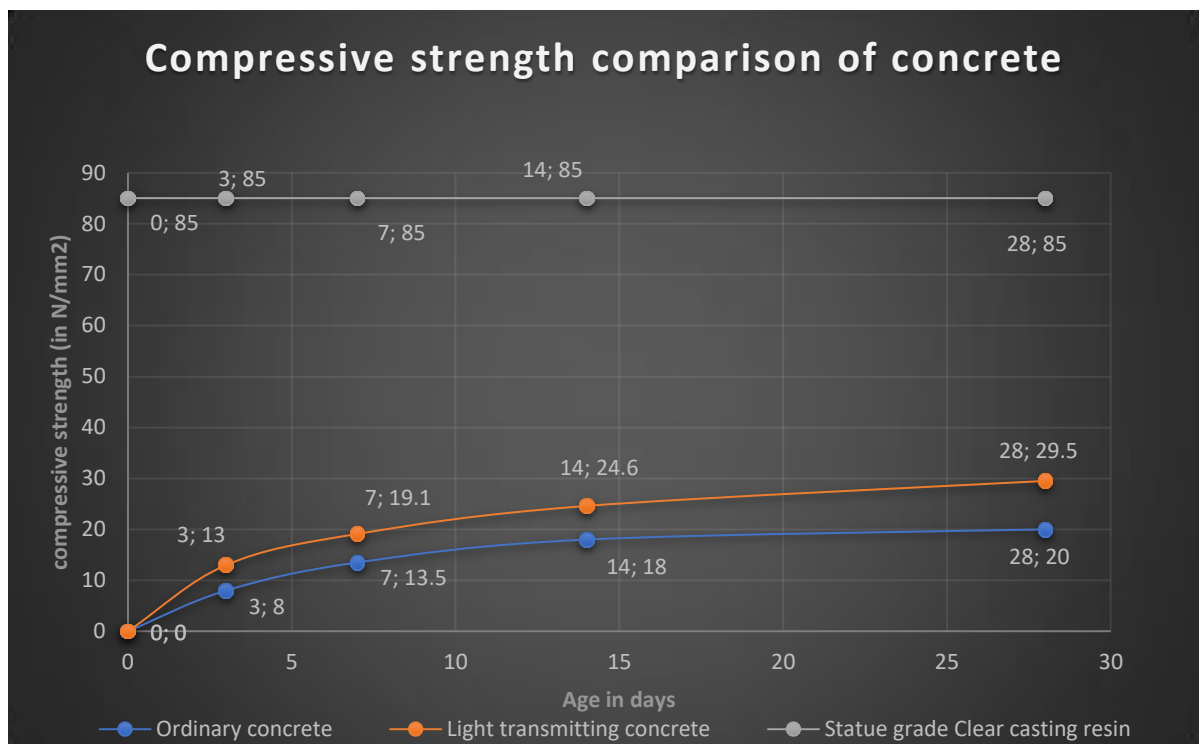


(a)

Fig.2.Graph (a) Showing Workability variations with respect to average workability



Test day	Ordinary concrete	Light Transmitting concrete	Casting resin
0 th day	0	0	85
3 rd day	8	13	85
7 th day	13.5	19.1	85
14 th day	18	24.6	85
28 th day	20	29.5	85



(a)

Fig. 3 Graph (a) showing variations of compressive strength along with time of ordinary concrete Vs. Light transmitting concrete using statue grade clear casting resin

V. CONCLUSION

1. Natural sunlight is utilized for interior illumination using statue grade casting resins gives satisfactory results.
2. Statue grade casting resin is lighter in weight so dead load over the structure reduced to a greater degree by using cast grade resin for light transmitting element in concrete.
3. Solar radiation is a renewable source of energy thus helps in electrical energy saving that is consumed in illuminating interiors of a structure thus helps in reduction in CO2 emission to the atmosphere.
4. Comparatively economic and environment friendly construction with respect to conventional method of construction.
5. It is a modern method of construction of aesthetical and pleasing structures

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