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Light Transmitting Concrete Using Glass Waste

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ABSTRACT: Saving energy and better appearance are two important factors for infrastructure. In this research work, the manufacturing of light transmitting concrete using glass waste is explained and providing a new option to minting the concept of sustainability which will help to minimise the consumption of energy in closed interior environment on the basis of regular means of illumination, which can prepare some portion of outside walls of the molds are manufactured of concrete, light transmitting which allow the emission of nature light from outside to inside. The experiments explain that glass waste can easily aided with concrete and that glass waste could give a desired light transmitting ratio. This research also explains the mechanical effects of adding glass waste into the M20 concrete specimen. Because the light transmitting concrete can be considered as energy saving building material it is profitable technology for field applications in the infrastructural work.

KEYWORDS: light transmitting concrete mix, glass waste

I. INTRODUCTION

Concrete has a crucial role in the development of civil engineering infrastructure and living accommodation. Multi-storey building and skyscrapers have replaced smaller buildings for area utilization due to increasing population worldwide the leading to develop new building materials and technologies. Regular building materials lack the ability of deriving natural lightening source into the living space which is increased the use of artificial sources for illumination of buildings. So it is very necessary to optimize the use of artificial sources of light in The buildings.

A project of manufacturing light transmitting concrete and at minimising this operating energy by exploiting was potential energy which is of Sunlight and other feature is its aesthetical appearance that can transform the image of the concrete which is generally considered as dull and opaque gray material. The main purpose of the light transmitting concrete block is reducing artificial energy use by utilizing sun light making the concrete as green construction material.

With the economic and scientific development, many more large civil engineering building structures like underground buildings, tall buildings, and landmark buildings and so on are constructed throughout the world. While the economic development is a type of extensive development: more input, more consumption and more pollution, for that energy saving technology is less effective, mainly in developing countries. The brightness of interior environment is entirely carried by artificial lighting like lamps, tube light etc., which has consumed a great quantity of resources. Moreover structures always face external environmental factors, economic rules and casualty are dangerous once damaged. Presently, building energy saving and building security have been pulled much attraction. The main issue to be discussed are the darkness and non-transparent concrete walls especially at early morning hours, and why don't depend on solar light instead of electric energy consumption, the interiors that required great lighting and electricity.

II. SIGNIFICANCE OF PROJECT

- 1- In past concrete act as structural member only but the concrete has changed by the globalization.
- 2- Newly developed building materials like light transmitting concrete have come up in which can be used for decoration.
- 3- Light transmitting concrete shows increased strength and also provide a better appearance to the concrete.

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This project aims making concrete strong, attractive, energy saving and environment friendly green building material

1- 50% of the lighting is mandatory in a building according to Indian green building Council (IGBC).

Light transmitting concrete is economical as the production cost of the glass waste is nil.

1- To use sunlight in the internal parts of structures.

2- To develop another technique for gaining non-conventional energy by using sun radiation for illumination.

To reduce weight of concrete which acts on the foundations of structures

III. MATERIALS

3.1 Cement

Cement consumed in the research work is Portland pozzolana cement (as per specification in Indian Standard code of practice 4031-1988 and 1489-1991(Part 1 and 2))

3.1.1: Physical properties:-(Table no.1)

S. No.	Property	Observed average value	Expected value
1	Specific gravity	3.10	$\cong 3.15$
2	Fineness modulus test	2.0%	$\leq 5\%$
3	Normal consistency	31.0%	25 to 38 %
4	Soundness	3.0 mm	$\leq 10 \text{ mm}$
5	Initial setting time	31 min	$\geq 30 \text{ min}$
6	Final setting time	580 min	$\leq 600 \text{ min}$

3.2 Aggregate

3.2.1 Fine aggregate:-

Fine aggregate was purchased which fulfilled the essential properties of fine aggregate required for research work and the sand conforms to zone II as specified in IS 383:1970.

3.2.1.1: Properties of fine aggregate (Table no.2)

S. No.	Property	Observed average value	Expected value
1	Specific gravity	2.650	$\cong 2.70$
2	Silt content	1.00 %	$\leq 6\%$
3	Bulking of sand	0.0	---

3.2.2 Coarse aggregate:-

The coarse aggregates used was 20mm nominal maximum size. The sieve analysis of combined aggregates confirmed as specified in IS 383: 1970 for graded aggregates

3.2.2.1: Properties of coarse aggregate (Table no 3)

S. No.	Property	Observed average value	Expected value
1	Specific gravity	2.680	$\cong 2.70$
2	Water absorption	2.00%	$\leq 6\%$
3	Flakiness index (F.I.)	0.80%	$\leq 10 \text{ to } 15\%$
4	Elongation index (E.I.)	2.0%	4 to 5 times of F.I.

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3.3 Water:-

Mixing water should not have unwanted organic matter or inorganic constituents in excessive proportions. In this research work clean potable water is used.(TABLE NO.4)

S. No.	Property	Observed average value	Expected value
1	pH value	7.0	6.5 to 7.5
2	Organic content	Nil	≤ 2000ppm
3	Inorganic content	105.67 ppm	≤ 3000ppm
4	Sulfate content	2.40 ppm	≤ 400ppm
5	Total suspended matter	4.0 ppm	≤ 2000ppm
6	Chloride content	0.1 ppm	≤ 2000ppm or 500ppm

3.4 Clear glass bottle waste of various drinks (TABLE NO.5)

S. No.	Property	Expected value
1	Refractive index	1.5
2	Compressive Strength	≥30 N/mm ²
3	Color	Color less
4	Packing	High quality
5	Position holder	Proper fitting



Figure 1 Light transmitting concrete

3.5 Mix design for M-20 Grade Concrete:-

- Target Minimum Compressive Strength in 28 days: 20 N/mm²
- Type of Exposure: Severe

IV. MANUFACTURING PROCESS

Light transmitting concrete is made of light transmitting concrete mix and glass waste. The manufacturing of Light transmitting concrete like the preparation of traditional Concrete. In Advancement glass waste medium is embedded in this manufacturing process. Due to glass waste, consistency and strength of light transmitting concrete are higher than the traditional concrete as determined. Almost free energy loss by light transmission through glass waste make the possibility to see light and even various colors through Light transmitting concrete can be seen even by very fatty wall. The resultant is like glass in concrete as newly developed construction material, which is similar in its outer surfaces as well as on its interior structures. The glass waste leads light passed between the two sides of the Light transmitting concrete blocks. Due to of their arrangement in concrete, the light striking on the shining side of concrete wall appears similar on the other side and there is no difference of outside light and interior of structure. Use of glass waste enhances the strength of concrete as it have relatively high strength. Moreover, the light colour also remains unchanged as it does not get divided in medium. Water to Cement ratio (w/c) is kept 0.50 in the concrete mix.

4.1 Test conducted on concrete:- These three tests are in carried on concrete-

- 1- Workability
- 2- Compressive strength test
- 3- Flexural strength test

4.1.1 Workability

The workability of light transmitting concrete is determined by slump test and compaction factor test.
Test Result:(Table no 6)

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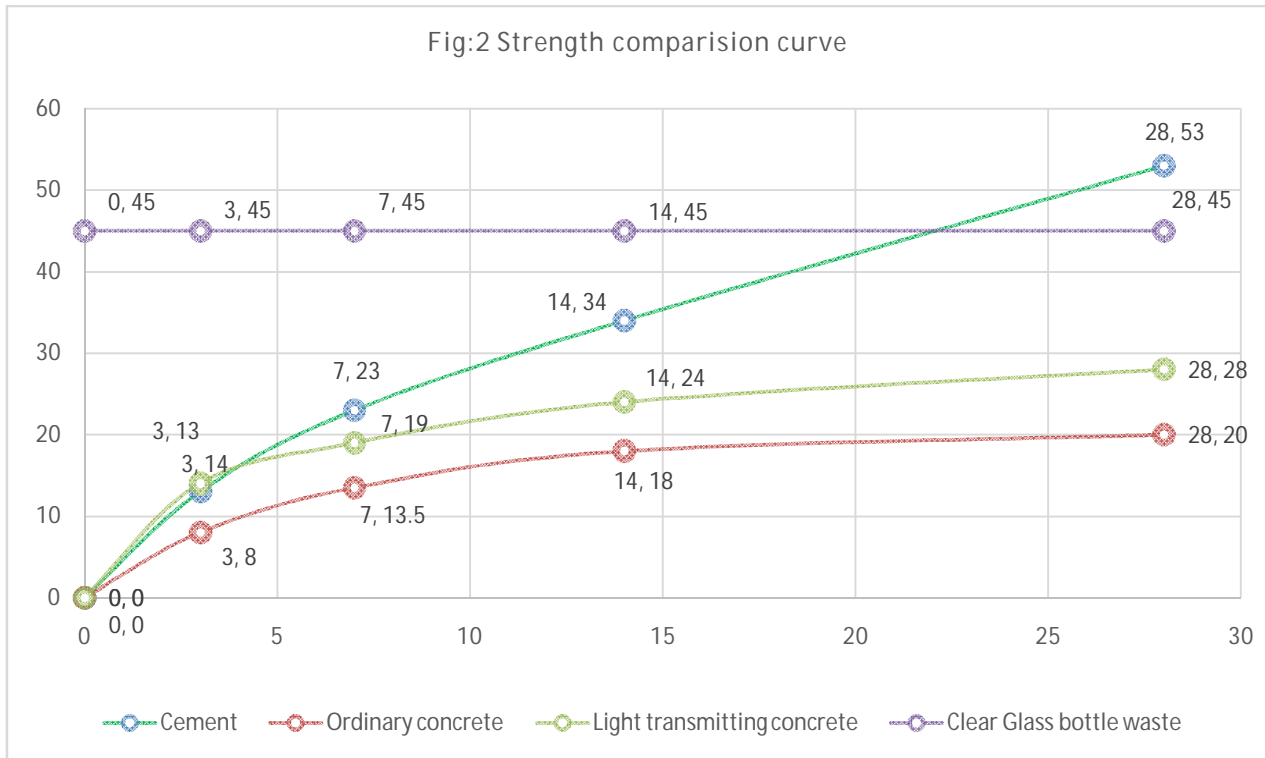
S. No.	CHARACTERISTICS	TEST RESULT	
		Slump (in mm)	Compaction factor
1	Workability test	80	0.90

4.1.2 Compressive Strength Test

- compressive strength of concrete is that value of uniaxial compressive stress at which the material fails entirely.
- The compressive strength is determined by compressive strength test.
- The compressive strength is determined by cube size 150mm150mm×150mm.

$$\text{Compressivestrength} = \frac{\text{Load}}{\text{Area}}$$

Test Result



(TABLE NO.7)

Test day	Observed Compressive strength (in N/mm ²)			
	Cement	Ordinary concrete	Light Transmitting concrete	Waste Glass bottle
0th day	0	0	0	45
3rd day	13	8	14	45
7th day	23	13.5	19	45
14th day	34	18	24	45
28th day	53	20	28	45

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4.1.3 Flexural Strength Test

Flexural strength of light transmitting concrete is determined by test on UTM. Flexural strength of concrete is defined as stress in concrete just before yields in flexural strength test.

$$\text{Flexural strength} = \frac{3Pl}{2bd^2}$$

Where, P =Applied load, b=width, d=depth, l=length

(Table no 8)

S. No.	Flexural strength test on 100×50×50cm beam			
	Observed value	Average value	Expected value in LSM	Average value
1	9.20	9.15	8.90	8.90
2	9.1		8.90	
3	9.20		8.90	

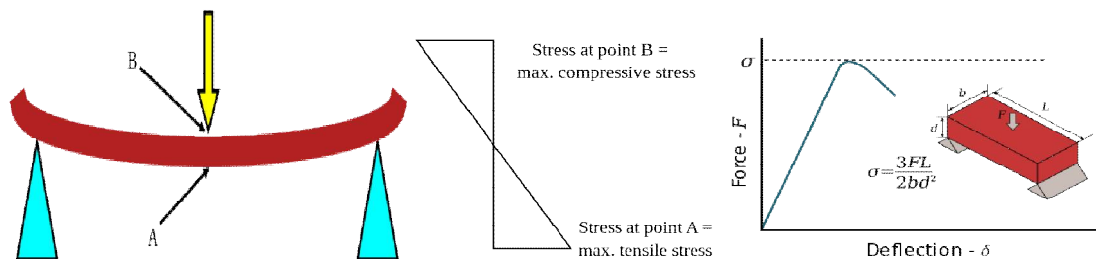


Figure 3 FLEXURAL STRENGTH DETERMINATION

Test Result:-Flexural strength of light transmitting concrete = 9.15N/mm²

V. CONCLUSION

1. The light transmitting concrete do not loses strength criteriaas compared with regular concrete.
2. It has Good light transmitting property.
3. Glasses waste is utilized since it harms the environment.
4. It has very crucial property for acidic point of view.
5. It can be used for better appearance of the structures.
6. Also applicable where the light cannot access with appropriate intensity.
7. Glass waste imparts reinforcement for the concrete.

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