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Light Emitting Concrete by Replacing the Coarse Aggregate with Industrial Glass Waste (100%,70%,50% Replacement)

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Abstract

The project involves the development of light-emitting concrete by replacing coarse aggregate with leftover shards of industrial glass, which act as the new type of innovation on this field. The discarded glass will be reused in this project, which will contribute to the development of transparent concrete. This is characterized by its ability to transmit light. This material can be used for various applications and is expected to give a new image to concrete. This type of concrete is commonly used in smart construction projects. It can be used to create a sense of the structure's stress and improve the appearance of the building. Compared to conventional concrete, light-emitting concrete is more lightweight. This project aims to introduce people to the concept of light-emitting concrete by developing a transparent and flexible optic fibre. Due to the increasing number of high-rise buildings being constructed globally, the need for smart construction techniques is also increasing. This material can be utilized in various applications such as smart thermal systems and green building.

Keyword: Optical Fibre, Waste industrial glass, Cement, Fine aggregate, Coarse aggregate, Smart thermal systems, Water, Energy efficient.

Introduction:

In 1935, Bernard Long mentioned the invention of transparent concrete in his patent. This type of concrete can be made by mixing around four to five percent of optical fibres in it. Architectures commonly use transparent concrete as a material. The goal of this project is to develop light-transmitting concrete by replacing the coarse aggregate with fragments of industrial glass, which act as the new type of innovation in this field. The discarded glass will be reused in this project, which will contribute to the development of transparent concrete. This type of concrete can be used for new construction projects and enhance the appearance of the building. In today's world, where the emphasis is on conserving natural resources, construction of green buildings is a good example of this. Through the research conducted in this field, we were able to create a transparent concrete that can be used as a front and internal component of a building. This paper aims to provide a comprehensive overview of the various advantages of this type of concrete and how it can be utilized in the construction industry. In addition to being able to create a beautiful environment, this type of concrete can also help people save energy.

Advantages

- By reusing the leftover fragments of glass, we can contribute to the waste management of the country.
- We can save the considerable cost of coarse aggregate by replacing it with the shards of industrial glass waste.
- For future development, a new solution has been found using waste glass instead of coarse aggregate.
- When a solid wall is imbued with the ability to transmit light it means that a home can use fewer lights in their house during daylight hours.
- It has very good architectural properties for giving good aesthetical view to the buildings.
- Energy saving can be done by utilization of transparent concrete in building.
- Totally environment friendly because of its light transmitting characteristics, so energy consumption can be reduced.

Detailed Procedure

- Preparation of mould

A wooden mould was prepared of volume 150*150*150 mm size wooden plates. The moulds were attached to each other in set of three, though a certain distance of 4cm were kept between two moulds, so than the long optical fibres can be inserted simultaneously at a time throughout all the moulds. These wooden plates were drilled with 1mm diameter holes with 2cm spacing for the insertion of optical fibre and then attached to form mould where one side of mould kept open for the filling of mixture as shown in the figure 1. So, six moulds (2 sets accordingly) like this are prepared for the compressive test of concrete cubes with the different percentage of glass shards/ fragments. Oil was applied around moulds so that specimen could fall off smoothly as shown in the figure 2.

Figure1 Mould Preparation

Figure 2 Oiling

- Arrangement of optical fibre

The optical fibre was placed as per the arrangement of holes drilled on the wooden mould. So, basically the holes drilled on the two parallel sides of a mould only so that, the optical fibres can be inserted horizontally throughout the moulds as shown in the above Figure3.

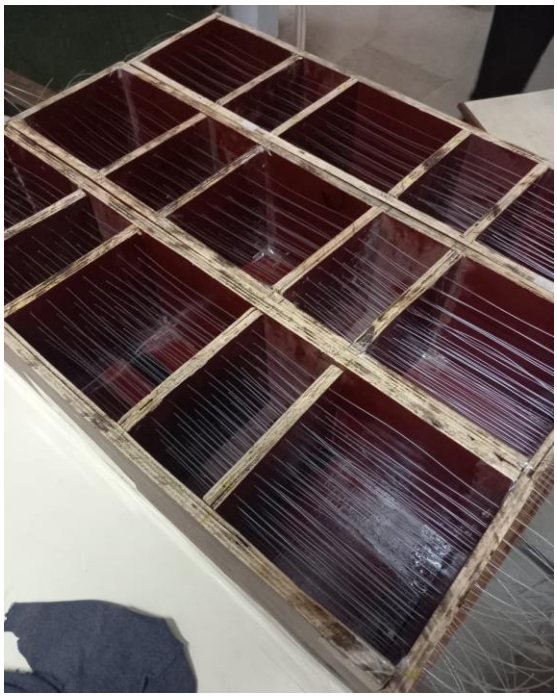


Figure 3 Insertion of optical fibre.

- .Preparation of glass shards

The leftover glass was collected from the near glass workshops and it was crushed to form uneven fragments of glass by manpower. Here we used glass fragments instead of glass powder for better strength and complementary replacement for coarse aggregate.

- Composing of blocks

After the preparation work was complete, the mixing and pouring process were carried out in strict accordance with the mass ratio of cement/sand/water/glass as shown in the pie charts below. During the pouring process, metal rod was used to eliminate the air inside the specimen and ensure the overall homogeneity of the specimen. After this the optical fibres were stretched to avoid dislocation of fibre internally. The next all concrete specimen were prepared accordingly to the above steps. The composition for each cube were taken as per the following compositions shown in the pie charts1, 2, 3.

Figure 4 Mixture of material.

- Curing of blocks

This process is also called as hydration. Curing is the process of maintaining satisfactory temperature and moisture conditions in concrete long enough for hydration to develop the desired concrete properties. The potential strength and durability of concrete will be fully developed only if concrete is properly cured. Hence, 0ne set of blocks has been kept for 7 days and another set was kept for 14 days to check the respective compressive strength of blocks of given compositions.

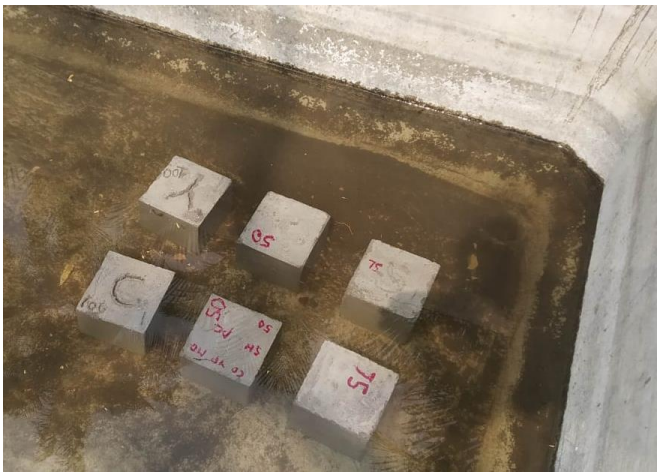


Figure 5 Curing of block

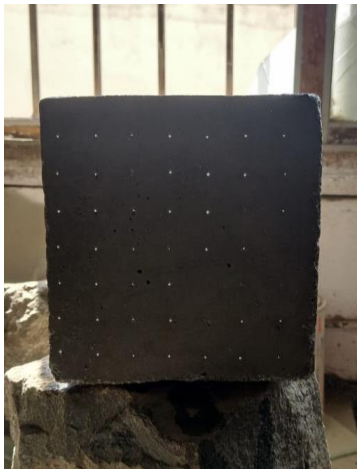


Figure 6 Transparent concrete block

- Compressive strength test

we have calculated the compressive strength using compressive strength machine Fig 1.6 and have obtain the following result.

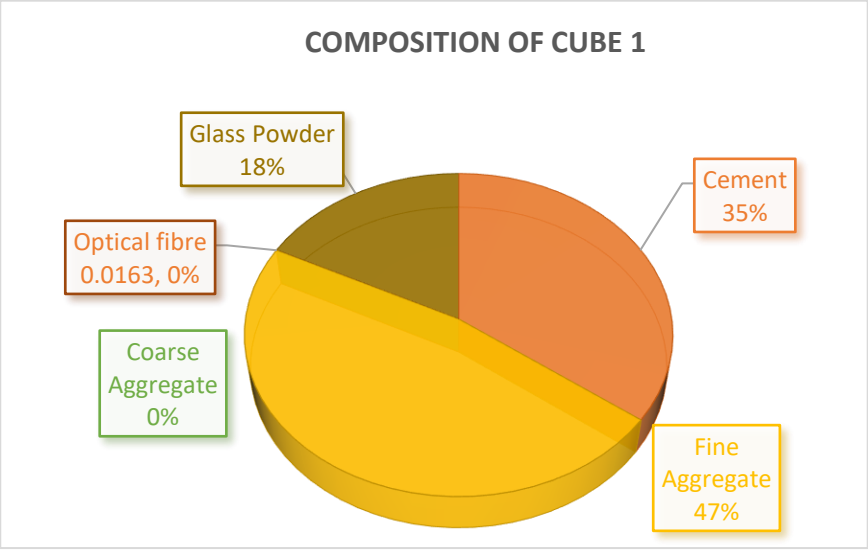
Figure 7 Transparent concrete block in UTM.

Composition of materials

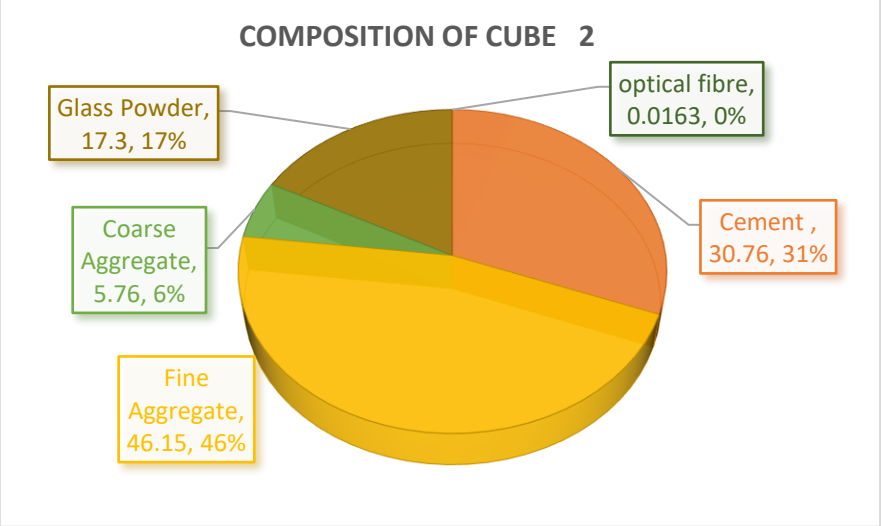
- Cement: M20, OPC (Ordinary Portland Cement)
- Sand:150 micron
- Water: Distilled water
- Coarse aggregate: 12 millimetres
- Glass: Waste industrial glass
- Optical fibre: 0.0163 kilogram in total weight (0.75 millimetres diameter)

Pie Charts of composition of material

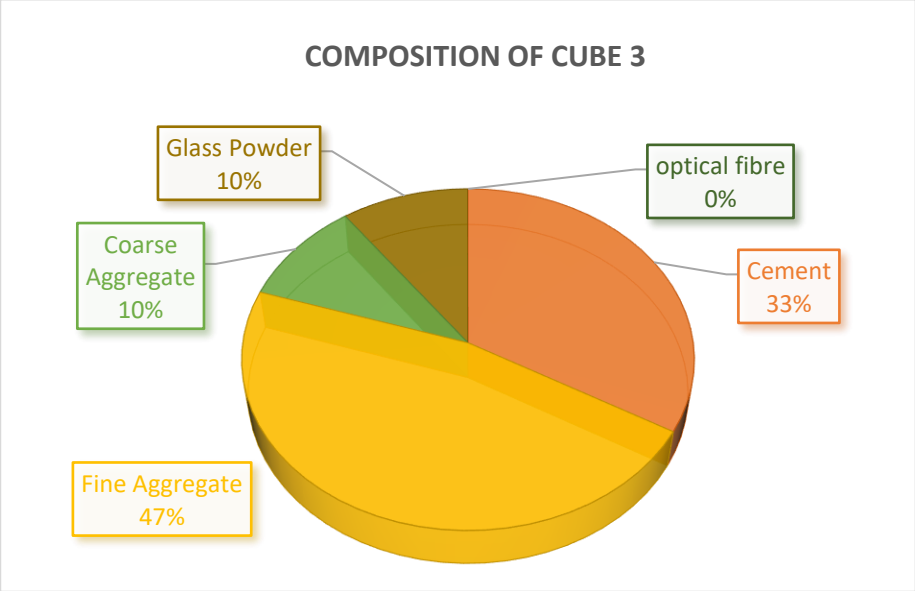
1. Composition of cube-1 where 100% replacement of coarse aggregate with glass.



2. Composition of cube-1 where 75% replacement of coarse aggregate with glass.



3. Composition of cube-1 where 100% replacement of coarse aggregate with glass.



Literature Review / Acknowledgement

A Review of Translucent Concrete as a New Innovative Material in ArchitectureDalia Elghezanwy*, Sara Eltarabily Department of Architecture and Urban Planning, Faculty of Engineering, Port-Said University, Egypt Received June 1, 2020; Revised July 13, 2020; Accepted July 29, 2020

Due to the increasing interest in green architecture, various disciplines are working on developing new materials that can meet the requirements of this concept. One of these is the use of translucent concrete. This type of material allows for the transmission of light through interior spaces.

The paper reviews the various studies that have been conducted on the applications of translucent concrete. It also focuses on their energy-saving and mechanical properties. The paper was able to highlight the remarkable achievements of these techniques in the last 10 years.

Despite the various advantages of translucent concrete, there were still gaps in the studies that were conducted on its applications. One of these was the use of different ratios of fibers. The studies that were conducted on the energy-saving and strength of translucent concrete revealed that the optimal ratio of fibers is between 4.3% and 6%

Exprimental Study on Transparent Concrete by using Plastic Optical FiberVisakh. V. A Department of Civil Engineering Anna University Kaniyakumari District

Due to the presence of light-transmissive elements such as glass powder and optical fibers, transparent concrete is a type of building material with excellent light-transmissive properties. These elements are carried through the stone through which the light is directed

TRANSPARENT CONCRETE AS A CONSTRUCTION MATERIAL BY USING OPTICAL FIBER Prof.Rashmi Vishwakarma 1, SanjiwaniTagade 2, AdeshGiri 3, Saurav Patil4, Rushikesh Borate5, Adesh Giri6 Department OF Civil Engineering, Dr.D.Y.Patil School Of Engineering and Technology,Lohegaon

Since the Roman era, concrete has been used for the construction of housing and infrastructure. It has three basic components: coarse aggregate, which is made up of large pieces of gravel or stone; fine aggregate, which is made up of smaller particles like sand; and cement, which binds the mixture together. The transparent concrete is mainly focused on its artistic and transparent nature.

Transparent Concrete ShreyasK. 1 1Asst professor Dept of Civil engineering Don Bosco Institute of Technology, Bangalore, India

Due to the presence of glass rods, transparent concrete is a type of concrete that can light up and transmit light. It is very lightweight and can be used for various applications. Its thermal conductivity and low density make it an ideal material for reducing dead weight and improving the construction process.

In modern era, transparent concrete has been introduced. It is a type of concrete with a special ability to light up and transmit light, and it is commonly referred to as light transmitting concrete. Compared to other types of concrete, it is lighter, has better thermal conductivity and lower dead weight, and it can be used for faster construction.

The main objective of this study is to design and construct translucent concrete blocks using glass rods and cement. It will then analyze the various engineering and physical properties of these blocks with respect to their conventional counterparts.

TRANSLUCENT CONCRETE: A RESEARCH PAPER Abhishek Pratap Singh1 , Sanjay kumar2 , Pankaj yadav3 , Piyush chauhan4 , Govind chaurasia5 , Hariom kumar6 1Resarch scholar, Civil department, B.I.T., Gorakhpur, U.P. (India). 2 lecturar, Civil department, B.I.T., Gorakhpur, U.P. (India). 3,4,5,6 are the associate research scholar, civil department, B.I.T., Gorakhpur, U.P. (India)

In this paper, we are going to be casting a block and a slab of size 18 x 7 x 7 cm3 and 100 x 7 x 300 cm3 respectively.

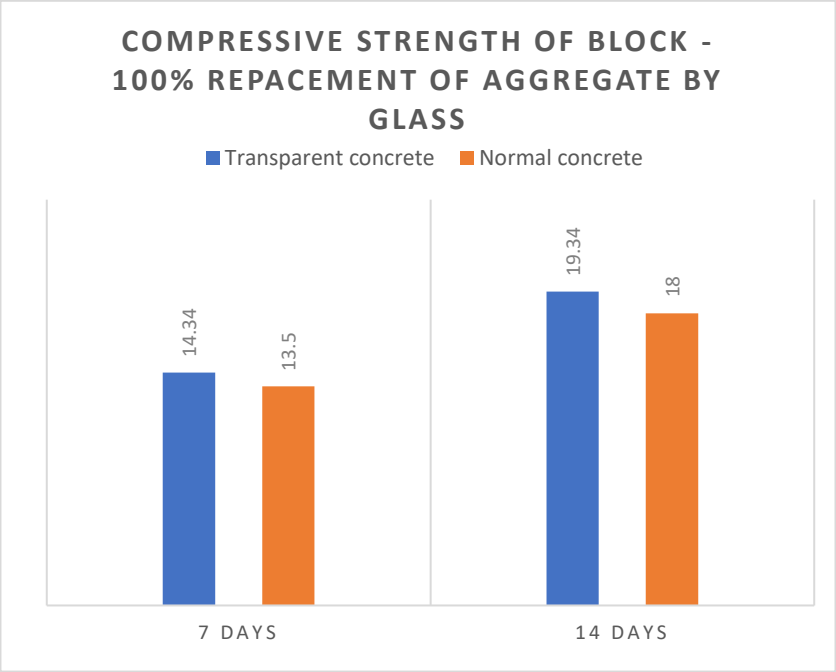
In this project, we are going to use various materials such as cement, sand, and aggregate. We are going to try to reduce the cost of this process.

We used a glass rod and a small amount of optical fibre to make this block. It allowed us to observe the light transmission.

Result and Conclusion

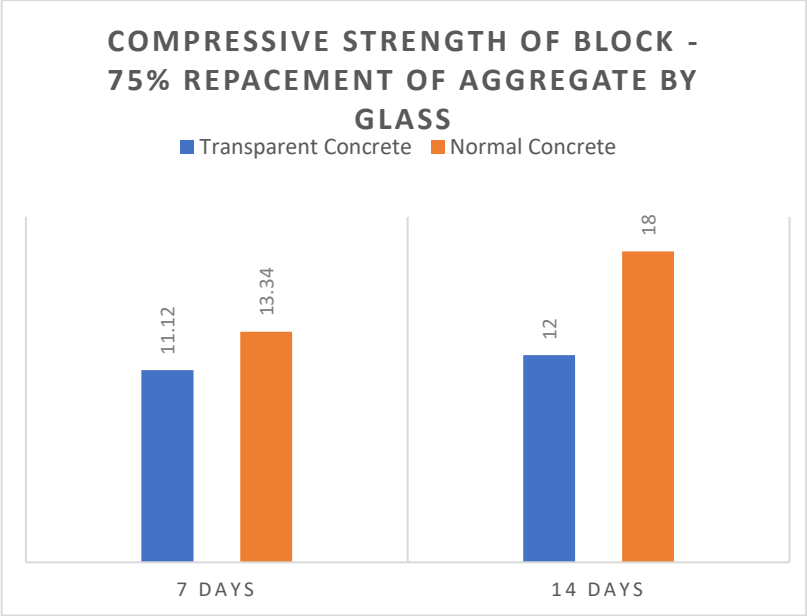
Comparison of compressive strengths of Transparent concrete (with glass) and normal concrete blocks.

1. Compressive strength (7 days and 14 days) of first block with 100% replacement of coarse aggregate with glass.



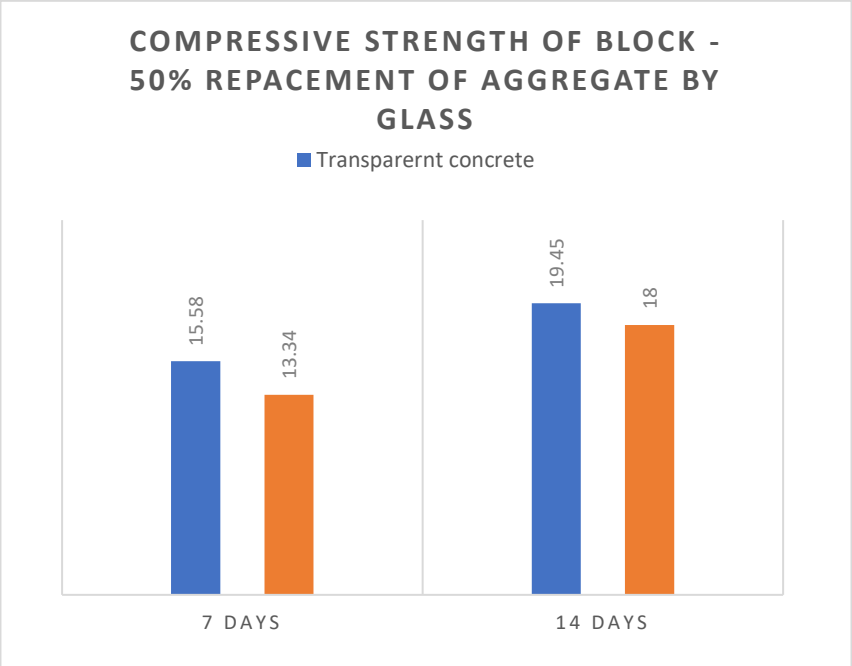
Graph1. Comparison of compressive strength of first block with Transparent concrete

2. Compressive strength (7 days and 14 days) of secondblock with 75% replacement of coarse aggregate with glass.



Graph 2. Comparison of compressive strength of second block with Transparent concrete

3. Compressive strength (7 days and 14 days) of 3rdblock with 50% replacement of coarse aggregate with glass.



Graph 3. Comparison of compressive strength of third block with Transparent concrete

7 Days and 14 Days compressive strength results

1. 7 Days compressive strength of three blocks.

% Replacement of coarse aggregate	7 Days compressive strength result		
	Block no 1	**Block no 2**	**Block no 3**
100%	14	14.34	15
75%	11	11.12	11.95
50%	15.01	15.58	15.74

Table 1. seven days compressive strength

2. 14 Days compressive strength of three blocks.

% Replacement of coarse aggregate	14 Days compressive strength result		
	Block no 1	**Block no 2**	**Block no 3**
100%	19	19.34	19.74
75%	11.85	12	12.5

50%	19.20	19.45	19.85

Table 2. Fourteen days compressive strength

Conclusion

- Results are obtained much higher than conventional(normal) concrete and more aesthetically pleasing and obtained this result and has pleasing architectural appearance as compare to transparent concrete.
- Also saves electrical energy as concrete emits light.
- Leftover industrial glass waste is utilized instead of coarse aggregate which is found to be a new green building solution.
- After analysing the results, it was concluded that replacing 75 percent of coarse aggregate with glass waste did not have much strength. On the other hand, using 50% and 100% of the aggregate with glass resulted in better strength.

References

1. Dalia Elghezanwy, Sara Eltarabily "A Review of Translucent Concrete as a New Innovative Material in Architecture", Research Gate, July 292020, 571-579.
2. Visakh.V.A "Experimental Study on Transparent Concrete by using Plastic Optical fibre", Research Gate, January 2022.
3. Abhishek Pratap Singh[1], Sanjay kumar[2], Pankaj yadav[3], Piyush chauhan[4], Govind chaurasia[5], Hariom kumar[6] "TRANSLUCENT CONCRETE: A RESEARCH PAPER", Resarch scholar, April 2018.
4. Shreyas.K "Transparent Concrete", International Journal of Engineering Technology Science and ResearchIJETSR, ISSN 2394 – 3386, March 2018.
5. Prof.Rashmi Vishwakarma 1, SanjiwaniTagade 2, AdeshGiri 3, Saurav Patil4, Rushikesh Borate5, AdeshGiri6, "TRANSPARENT CONCRETE AS A CONSTRUCTION MATERIAL BY USING OPTICAL FIBER", IJARW, ISSN (O) - 2582-1008, September 2020