

Transparent Concrete

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Abstract: Transparent concrete is a new technology used in the construction industry. It is a special type of lightweight concrete having the critical property of light transmission. It is made up of two basic materials-fine concrete and light transmitting material-glass or optical fiber. This paper gives description about the use of transparent concrete in the construction of a partition wall and its applications.

Keywords: Construction, critical lightweight, transparent.

1. Introduction

Concrete is the most widely used material in the construction industry. The researchers and manufacturers all over the world have been working together in order to produce new technologies in the manufacture of concrete, so that the overall quality and economic value of construction can be improved. As a result of which transparent concrete has been developed. The actual concept of transparent concrete was introduced by a Hungarian Architect, Aron Losonczy in the year 2001. The transparent concrete, otherwise called translucent concrete works on the theory of Nano Optics, in which the optic fibers act as slits to transmit light from one side of the surface to another. This can be manufactured by mixing 4-5% of optical fibers in the concrete.

2. Project Description

Transparent concrete is a concrete based building material which has got light transmitting property, due to the embedded light optical fibers in it. We have constructed a partition wall of dimensions 150cm x 60cm x 5cm using this transparent concrete.

A. Materials Used

1) Optical fiber

Flexible plastic transparent fiber of thickness 0.75 mm and l/d ratio of 0.93 is used.

2) Cement

For this, 53 grade Portland cement is used. The specific gravity of cement was 3.14 and the initial and final setting time were found out as 51 minutes and 540 minutes. Standard consistency of cement was 40%.

3) Water

Ordinary drinking water that is free from impurities, acids, alkalies etc., were used.

B. Manufacturing process

A sample specimen of size 15cm x 10cm x 5cm were made. For this, a mould of tile pieces with cardboard base were made. A V board having holes at equal spacing of 2cm were placed inside the mould for inserting optical fibers. The optical fibers were inserted into the holes and the mould is coated with oil before pouring concrete, so that adherence of concrete to the mould could be prevented. After 14 days of curing, compressive strength of the specimen was found out using Universal Testing Machine. Then, a partition wall of size 120cm x 60cm x 5cm was made. The water cement ratio of 0.45 with 2% of optical fibers were used.

The 14 days Compressive Strength of the sample specimen is 26.5 N/mm²

3. Importance of Transparent Concrete and its Applications

The important features of this concrete is that, it can transmit light as well as it is lightweight compared to conventional concrete. It helps in saving energy costs as it is capable of utilizing light from natural as well as artificial sources. So, the buildings can have fewer lights to meet its demand for lighting. It also provides aesthetic appearance to the structure. This can be used in a wide range of applications like partition walls, floors, furniture, facades, pavements, interior wall cladding, load-bearing walls etc. One of the main disadvantages of this concrete is that it is expensive than conventional concrete. This is due to the high cost of optic fibers.

4. Working Principle

Transparent concrete works on the theory of Nano Optics. In this, the optic fibers act as slits and allows the light to travel through it.

When light travelling through a denser medium hits a boundary at an angle greater than the critical angle, the light gets reflected. This phenomenon is called Total Internal Reflection. Due to the difference in refractive indices of the core and cladding of the optic fiber, total internal reflection of light occurs in the optic fiber which is responsible for passing the light through it. Thus, the optic fiber is responsible for allowing the light to pass through the concrete structure.

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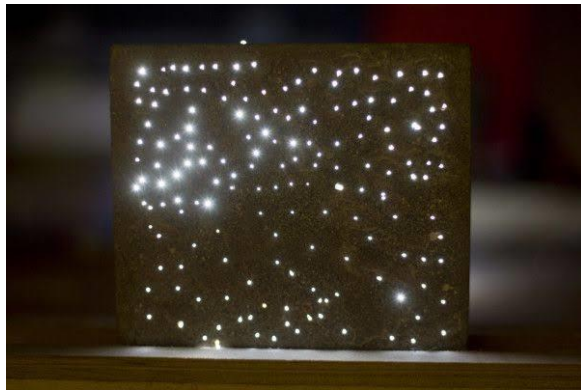


Fig. 1. Transparent concrete block

5. Conclusion

Transparent concrete is an emerging trend in the construction industry. It is an energy-saving technique that proved to provide aesthetic appearance. It has very stable light guiding property; thus, it adds an interesting property to a strong material. This could take the fiber optics in a new direction. It is also proven

from the compressive strength test value that, without the use of aggregates in the mix, we can obtain the same strength as of normal concrete as well as a lightweight material. Thus, the new technique of building material can integrate the concept of green energy saving.

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