Transparent Concrete With FerroCement

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Abstract- *To introduce buildings with walls that let sunlight filter through reducing the need for artificial lighting and creating a unique ambiants we put forward in this project transparent concrete with ferrocement. In this project OPC 53 grade cement, P sand for more finishing, 4% optical fibers by volume and wire mesh with size opening 50mm x 50mm. By introducing ferrocement to increase the tensile strength of the concrete. In the experiment the casting of specimen and the slab using ferrocement was cured for 7 days and then compression and flexural strengths are tested. This study presents a promising solution for sustainable and visually appealing construction material.*

Keywords- *Transparent concrete, Optical fiber, Ferrocement.*

I. INTRODUCTION

A fascinating combination of transparent concrete and ferrocement has emerged in the construction industry. Transparent concrete, with its light transmitting properties, offers architectural aesthetics and strength. Meanwhile, ferrocement known for its versatility and durability, complements this innovative material. This journal explores their properties, applications and significants in sustainable construction practices.

Ferrocement is a type of reinforced cement concrete (RCC) that consists of cement mortar and wire meshes. It is lightweight, durable, and versatile.It is of high tensile strength and stiffness, good influence and punching shear resistance, lightweight and low shrinkage and impermeable structures with a low water-cement ratio.Ferrocement is used in water tanks, shell roofs, boat hulls, and more. Both transparent concrete and ferrocement contribute to innovative and sustainable construction practices. Their unique properties open up exciting possibilities for architects, engineers, and designers.

The optical fibers could carry light around corners and over distances of tens of meters, depending on the fiber type and bending characteristics. When working with natural light, it is essential to ensure sufficient illumination.fibers allow light to travel through the concrete from one end to the other, resulting in a captivating visual effect.This innovative material finds applications in fine architecture as a facade material and for cladding interior walls.

II. LITERATURE REVIEW

Akshay Praveen Meshram, et al.,(2021) The paper discusses the basic principle, previous applications and uses of transparent concrete in different fields. This paper also compiles the finding and results of the previous research and studies on transparent concrete, which can be used as a base to carry out further studies and development in the field of transparent concrete. The transparent concrete mainly focuses on transparency and its objective of application pertains to green technology and artistic finish. It is the "combination of optical fibers and fine concrete".At present, green structures focus greatly on saving energy with indoor thermal systems.

Aswathi. R, et al.,(2023) The function of this invention is to change the traditional image of concrete and add a modern architectural touch**.** In order to reduce the energy consumption by structures and also the upcoming building construction in future. Many researchers and scientists were attracted towards the development of new construction material which will consume very less amount of energy. Transparent concrete is the concrete is one such new developed material. In this optical plastic fiber can transmit the light from one end of the fiber to another.

Akshaya. B. Kamdi, et al.,(2013) Transparent concrete is one of the most interesting new takes on the historically stiff and uninspiring building material. It could be used almost anywhere glass or traditional concrete are used. Translucent concrete combines the fluid potential of concrete with glass ability to admit light, and it also retains privacy and can be used as structural support. The possibilities for translucent concrete are innumerable; the more it is used, the more new uses will be discovered. As with any new material, it is expensive and still has some issues to be resolved. In the next few years, as engineers further explore this exciting new material, it is sure to be employed in a variety of interesting ways that will change the opacity of architecture as we know it.

Braja Gopal Dey, et al.,(2018) Transparent concrete in architecture is used as a facade material and for new designs

to make the construction look much attractive. Transparent concrete is a new innovation in concrete. It is no longer the same old, heavy, grey material with zero transparency. It is now innovated and reformed as a good looking, lively and beautiful concrete with more resistance, lighter in weight, weight or colored etc. Transparent concrete can be produced by adding optical fiber in the fine concrete mixture. It has good light transmitting property, which is directly depended on the ratio of presence of optical fiber to the total volume of concrete. . This new type of concreting represents the concept of "GREEN BUILDING" with self-sensing property of it.

III. MATERIALS ANDMETHODOLOGY

3.1 MATERIALS USED

3.1.1 Ordinary Portland Cement

Cement helps to fill the voids and gives density to the concrete.

Table 1: Physical properties of cement

3.1.2 Water

Water should be free from acids, oils, alkali, vegetable or other organic impurities. Soft waters produce weaker concrete. Water has two functions in a coarse mix. Firstly, it reacts chemically with the cement paste in which the inert aggregates are held in suspension until the cement paste has hardened. Secondly, it serves as a lubricant in the mixture of fine aggregates and cement.

3.1.3 Chicken Wire Mesh

Chicken mesh is used as a metal lath to hold cement or plaster, a process known as stuccoing. Concrete reinforced with chicken mesh yields ferrocement, a versatile construction material that can be used in a wide range of applications.

3.1.4 Optical Fiber

An optical fiber is a cylindrical dielectric waveguide made of low-loss materials such as silica glass. Light rays incident on the core-cladding boundary at angles greater than the critical angle undergo total internal reflection and are guided through the core without refraction.

3.1.5 Sand

The transparent concrete is manufactured only using fine materials, the size of sand should pass through a 2.36 mm sieve. P sand is quite famous for its consistency and the fine and smooth texture it has.

Table 2 : Physical properties of sand

Sl.no.	Properties	Result
1	Sieve analysis	4.96
2	Specific gravity	2.51

3.2 METHODOLOGY

Table 3 : Materials specifications

Sl. No	Material	Specification
1	Cement	53 Grade
2	Sand	2.36 mm sieve passing (P sand)
3	Optical Fibers	0.75 mm
4	Cement : Sand	1:1.5
5	Chicken Mesh	Sizes of openings: 13mm x 13mm

3.2.1 Preparation of Mould

A mould of rectangular cross section of size 31.2 cm × 12.2 cm × 2 cm is made with tile pieces. The chicken wire mesh can be cut out according to that. Thermocol piece and the wire mesh is placed inside the mould.

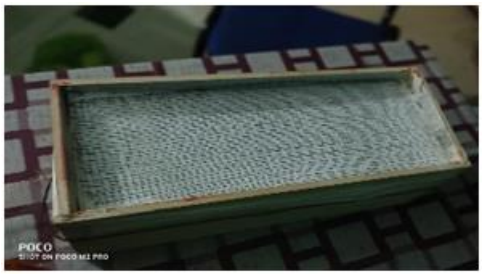

Fig 3.1: Preparation of mould

3.2.2 Placing of Optical fiber

Fibers are placed either in organic distribution or in layered distribution. Holes are driven on the thermocol placed through which optical fibers are inserted.

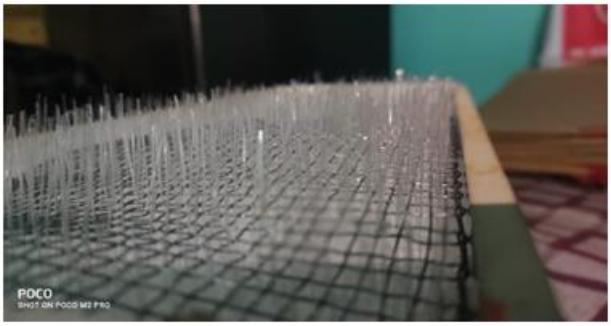

Fig 3.2 : Placing of optical fiber

3.2.3 Concreting

Pour oil or grease on the sides where the optical fibres are exposed to the mould for the easy demoulding after the concreting. The thoroughly mixed concrete paste is poured carefully and slowly without causing much disturbances to previously laid optical fibers. The concrete is filled in smaller or thinner layers and is agitated to avoid the void formation.

Fig 3.3 : Pouring of concrete in the mould

3.2.4 Removing the Mould

After 24 hrs, remove the mould. The casted mould was kept undisturbed on the leveled platform. Then it was de-moulded after 24hrs from casting. After 24 hours, mould is dismantled, the specimen is kept for 7 days curing.

Fig 3.4 : Demoulding

3.2.5 Finishing

After curing period, the specimen is taken out of curing apparatus. The extra long fibers are cut to the same thickness as of the panel.

Fig 3.5 : Finishing

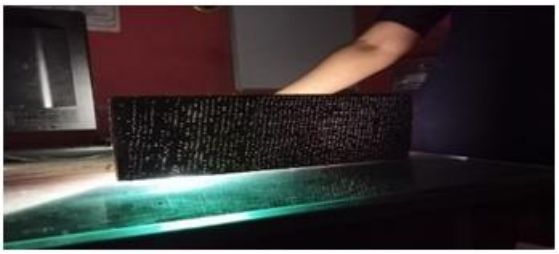

Fig 3.6 : Finished concrete block transmitting light

3.2.6 Test Conducted

Compressive Strength Test

The compressive strength of specimen was calculated by formula :

$$\mathbf{F_{ck} = P/A}$$

Where,

P= failure load in compression in N
A= cross sectional area of specimen in mm^2
F_{ck}= compressive strength in N/mm^2

Flexural Strength Test

The flexural strength of specimen was calculated by formula :

$$\mathbf{F_b = 3Pa/bd^2}$$

Where,

F_b= flexural strength in N/mm^2
P= maximum load applied in N
b= width of specimen in mm
d= width of specimen in mm
a= distance from the nearest end support where the specimen breaks

IV. RESULTS

Table 3 : Test Results

	Conventional Transparent Concrete (N/mm^2)	Transparent Concrete with Ferrocement (N/mm^2)
Compressive Strngth Test	21.99	23.717
Flexural Strength Test	170.414	187.88

V. CONCLUSION

By introducing ferrocement in transparent concrete strength increased as reinforcement increases tensile strength of concrete.The increase in strength between conventional TC and TC with ferrocement is 7-9 % in compression and flexural tests.By using the optical fibres and wire mesh the wear and tear of structures can be reduced, therefore can be used in humps in roadways and pathways with lights inside can be an innovation in night traffic , increased durability, cost effective when uses plastic fibers.

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