“Light transmitting concrete by using optical fiber and partial replacement of sugar cane ash”

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Abstract: Light transmitting concrete is a unique sort of solid that permits light to go through it. Quality of this solid is practically same as of ordinary cement. It is famously utilized in green structures to spare power. In the present created world electrical vitality utilization is exceptionally high. The brilliance of indoor condition is totally kept up by fake lighting, which has expended a lot of assets. It is observed that the usage of sugarcane bagasse ash in concrete helps in increasing the resistivity towards sulphate attack. The percentage reduction in compressive strength was decreasing with increase in percentage replacement of sugarcane bagasse ash when cured in 5% MgSo4 which concludes that SCBA helps in resisting the concrete towards sulphate attack. The usage of SCBA in concrete is not only a waste-minimizing technique, also it saves the amount of cement. The replacement of cement with SCBA increases the workability of fresh concrete; therefore, use of super-plasticizer is not essential.

Keywords: Light transmitting concrete, sugar cane ash

1. Introduction
Concrete is a significant development material, made out of concrete (ordinarily Portland concrete) just as different cementitious materials, for example, fly debris and slag, total, water, and substance admixtures. Solid fixings set and solidify subsequent to blending in with water because of substance process known as hydration. The water responds with the concrete, which bonds different segments together, in the end making a stone-like material. Concrete is utilized more than some other man-made material on the planet. The advanced development material is light transmitting concrete. It is otherwise called translucent cement. In 2001 Aron Losonczi, a Hungarian Architect built up an exceptional solid that permitted light to go through it by utilizing 4% optical filaments. Light Transmitting Concrete (LTC) is favoring answer for simpler day-lighting. It targets lessening the working vitality by misusing
tremendous measure of vitality as daylight. Light transmissive property is chiefly because of uniform circulation of high numerical optical filaments all through its body.

1.2 Light Transmitting Concrete

LTC is a mix of fiber optics and cement. It very well may be delivered as pre-assembled fabricating filaments structure a grid and run corresponding to one another between the two fundamental surfaces of each square. These filaments blend in the solid squares and boards. Because of the little size of the strands, they mix into concrete turning into a part of the material like little bits of total. On account of their equal situation of fiber, the light-data on the more brilliant side of a divider seems unaltered on the darker side. The sharp presentation of shadows will fall on the rival side of the divider. Besides, the shade of the light likewise continues as before. A huge number of optical due to their immaterial size, and they become an auxiliary part as a sort of unobtrusive total. In this way, the outside of the squares stays homogeneous cement. LTC is utilized in fine design as a veneer material and for cladding of inside dividers. Light-transmitting concrete has likewise been applied to different structure items. At the point when a strong divider is saturated with the capacity to transmit light, it implies that a home can utilize less lights in their home during sunshine hours so it is vitality saving. Translucent solid comes in as a gift answer for simpler day lighting. By orchestrating numerous optical filaments into solid it transmit light so viably that there is practically no loss of light led through the strands. The optical filaments have appropriate light controlling property and detecting favorable circumstances, for example, little measurements, circulated estimation and hostile to consumption qualities, optical strands have been generally embraced in the correspondence and detecting fields.
2. Methodology

![Flowchart of cube casting and testing](image)

**Fig 2.1: Flowchart of cube casting and testing**

3. Preparation of cube specimen

- Clean the standard cube moulds 6 Nos. Thoroughly and tight all nuts - bolts properly.
- Apply oil to all contract surface of mould.
- Size of mould is normally 150X150x150 mm
- Take the random sample from the mixing spot while concreting.
- Fill the concrete in cube in 3 layers.
• Compact each layer with 35 strokes per layer for 150mm moulds, using a tamping rod. 4 corners of cube mould must receive 7 strokes and 7 strokes at center of cube mould. Each layer must be compacted allowing the rod passes into the underlying layer also and the bottom most layer must be compacted throughout its depth.

• Remove the surplus concrete after the mold is fully filled. Level the top surface and smoothen it with a trowel.

• Mark the cube surface with an identification number (say as 1,2,3 etc.) with a nail or match stick and record these numbers in respect with the concrete truck and location of pour where the sampled concrete is obtained.

• Cover the mould by damp hessian cloth immediately to prevent loss of water.

• Each specimen should be taken from various locations of proposed concreting.

• After 24 hours remove specimen out of mould.

• While removing, take care to avoid breaking of edges.

• Put coding on cubes by paints or marker, coding should be self-explanatory showing site name, concrete location, building Number and date of casting.

• Submerge the specimen in clean fresh water till the time of testing.

• Test 3 specimens for 7 days and 3 specimens for 28 days curing.

• Average strength of 3 cubes represents the strengths of concrete of particular portion of the structure.
3.1 Specimen:

Fig 3.1: Mould size

8 concrete cubes of 150mmx150mmx150mm size of M25 grade concrete are prepared.

3.2 Placing of optical fibers and casting:

Fig 3.2: Placing of optical fibers

- Clean the moulds and apply oil.
- Fill the concrete in the moulds in layers approximately 5cm thick.
- Compact each layer with not less than 25 strokes/layer using a tamping rod(16mm dia. And 60cm long bullet pointed at one end)
• Level the top surface and smoothen it with trowel.

4. Results and Discussion

Table 4.1 Compressive strength of cubes of different percentage

<table>
<thead>
<tr>
<th>DAYS</th>
<th>LOAD IN N/mm² (0%)</th>
<th>LOAD IN N/mm² (1%)</th>
<th>LOAD IN N/mm² (3%)</th>
<th>LOAD IN N/mm² (5%)</th>
</tr>
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<tbody>
<tr>
<td>7 days</td>
<td>17.25</td>
<td>24.4</td>
<td>23.6</td>
<td>22.8</td>
</tr>
<tr>
<td>14 days</td>
<td>31.3</td>
<td>26.93</td>
<td>24.04</td>
<td>22.3</td>
</tr>
</tbody>
</table>

Compressive Strength for 7 days

Table 4.2 compressive strength for 7 days

<table>
<thead>
<tr>
<th>sl no</th>
<th>% of fibre added</th>
<th>Compressive strength &quot;Mpa&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0</td>
<td>17.25</td>
</tr>
<tr>
<td>2</td>
<td>1%</td>
<td>24.4</td>
</tr>
<tr>
<td>3</td>
<td>3%</td>
<td>23.6</td>
</tr>
<tr>
<td>4</td>
<td>5%</td>
<td>22.8</td>
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</tbody>
</table>

Fig. 4.1 compressive strength for 7 days
Compressive Strength for 28 days

Table 4.3 Compressive Strength for 28 days

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Fig.4.2 compressive strength for 28 days

- Compressive strength of the concrete is decreases with an increasing percentage of optical fibers.
• For 7 days of curing comparing to normal concrete by adding 5% of optical fiber there is an
decrease in compressive strength of 30.21Mpa.
• For 28 days of curing comparing to normal concrete by adding 5% of optical fiber there is an
decrease in compressive strength of 29.65Mpa.

5. Benefits of optical fiber

• Safe - No electricity, heat, or ultraviolet light in the fiber optic cable. Ideal for use in and around
water, precious artifacts, paintings, combustible surfaces, etc.
• Versatile- Multiple applications possible from one light source.
• Economical- Operates on less than two amps.
• User friendly- The cable is durable, UV protected plastic, so there is nothing to break or burn
out. Virtually maintenance free.
• Size- It has smaller size and greater information carrying capacity.
• Speed- It has faster speed with less attenuation, less impervious to electromagnetic interference
(EMI).

6. Conclusions

In view of the past examinations, It was accounted for the quality of solid saw as increment
till 4% optical fiber and diminished at 5% optical fiber. As we expanded the percent of optical fiber
from 2% to 3%, light power expanded and was high during evening. It was accounted for that,
adjustment in surface zone of solid square lead to diminish in the light force. Light transmitting solid
gives aesthetical view to structures and is vitality proficient. According to conversation, cost of light
transmitting concrete is high yet cost is supported on account of its preferences. This exploratory
examination by supplanting the concrete in concrete by sugar stick debris by 5-25% proportion and
directing compressive quality test and droop test on coming about cement. The test outcomes showed
that the concrete could be profitably supplanted with sugar stick debris up to a greatest constraint of
12.5%.for M35 concrete, additionally the investigation uncovered that the compressive quality may be
expanded up to 10% substitution while past 15% substitution the quality was seen as diminishing.The
fibers can be used in concrete for decorative purpose.

• The major purpose of light transmitting concrete is created as a model and the light transmission
is made of the illuminating side of the concrete.
• This decorative concrete can be used in interior design of buildings as panels in slabs, walls etc.
• The decorative concrete can be used in place of windows because it can transmit the sunlight.
• Hence the application of optical fiber will make the concrete decorative as well as can make the concrete structural efficient.
• It is recommended that future research should be performed to assess the use of SCBA in concrete for several properties of concrete for example modulus of elasticity, flexure test, split tensile test, drying shrinkage etc.

References
1. Awadhesh Kumar, Rahul Ahlawat,”Experimental Study on Light Transmitting Concrete”, volume:04,issue:06,June-2017, IJISET