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AN EXPERIMENTAL STUDY AND MECHANICAL PROPERTIES OF TRANSPARENT CONCRETE

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Abstract - *Transparent concrete is the concrete based building material with light Transmissive properties in which the light transmitted either manually or artificially from one end to another end of the concrete. Transparent concrete is also known as translucent concrete and light transmitting concrete (LiTraCon).Three types of mould are prepared for this project they are cube, cylinder, wall panel. One side of the mould contain thermal to insert POF of 0.75mm. The M25 grade concrete is poured into the mould. The concrete mix contain glass fiber with different percentage (0.5%, 1%, 1.5%, 2%) using this properties concrete is made and they are tested to find the mechanical properties and illumination characteristics. It is able to use prefabricated buildings and wall panel. The main advantages is to reduce the power consumption during the day time by utilizing sunlight and also it provides highest UV resistance. It gives good aesthetic view of the building as totally environmental friendly as well as "GREEN BUILDIND".*

Key words: Cement, M-Sand, glass fibre, plastic optical fibre, mechanical properties, illumination characteristics.

1. INTRODUCTION

Concrete has learned to adapt to almost all new challenges that appeared. Now a days in the construction of building there are mostly high rise building are constructed. Due to the natural sunlight fails to fall inside the building. Because Of this there is a need of electricity in day time .At present and in the upcoming days the temperature is in upcoming days the temperature is in increasing condition during the day time. In both day and night time the power consumption is must in the subways. To overcome such problems the light transmitting concrete is in the form of wall panels or concrete blocks as prefabricated structures. By using this technique, we can get natural sunlight inside the building which is also said as the concept of "GREEN BUILDING".

1.1 Materials used

- CEMENT
- FINE AGGREGATE
- COARSE AGGREGATE
- GLASS FIBRE
- PLASTIC OPTICAL FIBRE
- THERMACOL
- NON-FLEXIBLE STICK WITH MINIMUM THICKNESS

Fig -1: Plastic Optical Fibre

2. EXPERIMENTAL STUDY

2.1 Cement

In this project 53 grade OPC cement is used which was manufactured by ultra-tech cement.

2.2 Fine Aggregate

In this project manufactured sand is used which passes through IS 4.75 sieve and conforming to zone II.

2.3 Coarse Aggregate

For panel small size aggregate are used which is retained in IS 4.75 sieve and for concrete blocks alternate sizes of medium sized aggregate was used.

2.4 Plastic Optical Fiber

POF having 0.75mm thickness which is pure white color is used.

2.5 Glass Fiber

The glass fiber having the thickness of less than human hair is used.

2.6 Non-flexible stick

This non-flexible stick is used to make that fiber straight without any deviation or oscillation which was inserted in the mould.

3. MANUFACTURING PROCESS

A mould is taken which is covered by four sides. The bottom of the mould is containing thermacol. The thermacol having some holes of small diameters with in calculated intervals. In that holes a bunch of POF is inserted with the help of non-flexible stick to avoid deviation then both the edges are tied (or) kept together by using some parting bands.

The concrete consisting of cement, Fine aggregate, coarse aggregate, plastic optical fibre and glass fibre are prepared with perfect water content required. The grating of the concrete in M25.The mix proportions are calculated by using specific gravity of material used then the fresh concrete is made.

The fresh concrete is poured into the mould by3 layer and the compaction is given for each layers without disturbing POF. After than finishing is made.

In this project three mould is made:

- Wall panels (size =1.2x0.45x0.025m)
- Concrete blocks (size =0.15x0.15x0.15m)
- Cylinder mould (Dia=0.15m, Ht=0.3)

After the 24 hours demolding is done .Then allowed for curing and then tested.

Both the conventional and LiTraCoN of cube and cylinder specimen is tested after 7 days and 28 days of curing and the wall panel specimen tested after 28 days only. The strength difference between conventional concrete and LiTraCoN is noted for wall panel which is made with POF and 2.0% of glass fibre and the strength for various percentage of glass fibre added to the LiTraCon such as 0%, 0.5, 1.0%, 1.5%, 2.0% and also POF inserted in that concrete for cubes and cylinders are noted. For each percentage variation 3 number of cubes and cylinders are manufactured and then tested.

4. TESTS ON HARDENED CONCRETE

- Compressive strength.
- Split tensile strength.
- Flexural strength.
- Light transmittance test.

5. RESULT AND DISCUSSION

5.1 Compressive Strength

Table -1: Compressive Strength Test

SI.NO	%OF GLASS FIBRE	7DAYS (N/MM²)	28DAYS (N/MM²)
1	0%	18.5	26.7
2	0.5%	19.3	28.1
3	1.0%	20.4	29.8
4	1.5%	21.4	31.5
5	2.0%	22.4	33.6

The below chart represents the results of compressive strength, in this the x-axis represents the percentage of fiber and y-axis represents the strength.

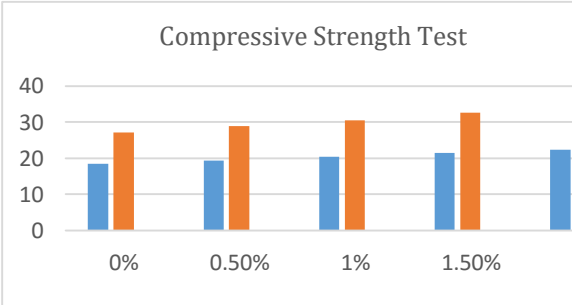

Chart -1: Compressive Strength Test Results

5.2 Split Tensile Strength

Table -1: Split tensile Strength Test

SI.NO	%OF GLASS FIBRE	7DAYS (N/MM²)	28DAYS (N/MM²)
1	0%	1.7	3
2	0.5%	2.1	3.2
3	1.0%	2.4	3.4
4	1.5%	2.7	3.65
5	2.0%	3.0	3.9

The below chart represents the results of compressive strength, in this the x-axis represents the percentage of fiber and y-axis represent the strength.

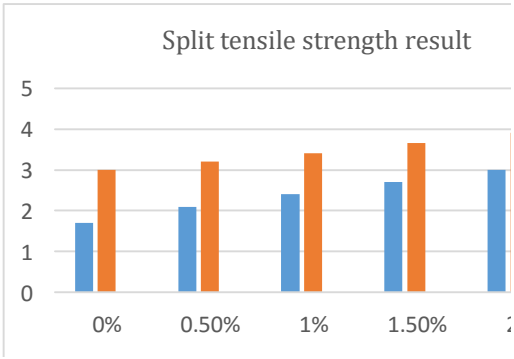

Chart -2: Split Tensile Strength Test Results

5.3 Flexural Strength

Table -3: Flexural Strength Test Results

SI.NO	TYPES OF PANEL	28DAYS
1	LiTraCon panel	2.248
2	Conventional panel	2.138

5.4 Light Transmittance Test

Fig -2: Light Transmittancy Through Cylinder Specimen

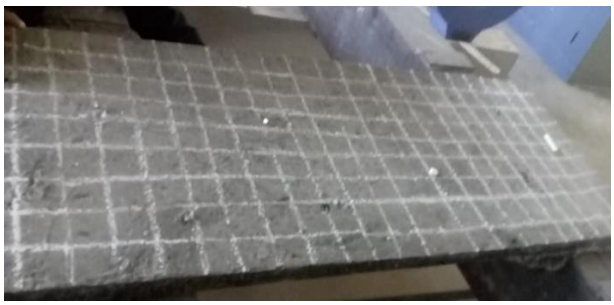

Fig -3: Light Transmittancy Through Wall Panal Specimen

5.5 DISCUSSIONS:

After seeing the results of both the cube and cylinder specimens it is discussed that, the strength of the specimen gets increased by increasing the percentage of glass fiber and the light transmittance by the POF is good enough on both ages of 7 and 28 days. Also same for the wall panel results on the age of 28days that is observed by comparing the conventional wall panel and LiTraCon wall panel.

It is observed that the light passing through the specimens is good enough. It also provides good aesthetic view. Even though there is a zig-zag way of POF the light transmittance is clear without any disturbance.

6. CONCLUSIONS

1. As per the result analysis we are conducted that the strength of concrete which is mixed with glass fibre and POF is greater than conventional concrete by proper compaction and curing.

2. By increasing the percentage of glass fibre the strength is increased and the POF inserted should be within the limit based on requirement of natural light because the more usage of POF also reduces the strength of the concrete.

3. Transparent concrete is very much eco-friendly because it reduces the carbon emission .which is dangerous to the environmental, it provides highest UV resistance and it also act as heat insulators.so that the concrete less not easily allow the heat and maintains the temperature.

4. The power consumption during day time is reduced by utilizing the natural sunlight source in the high rise buildings also the green building concept.

5. The disadvantage is the initial cost of LiTracon is greater than conventional concrete by 12 times, but by payback calculation analysis that the excess amount invested for 3.5 years for domestic consumption &2.1years for commercial &industrial consumption.

6. It is also treated as one of the high performance concrete and it gives good aesthetic view of the building during day times similarly at the night time by using the light use can made a colour of light source due to the usage of pure colour POF. The POF concrete blocks also used as a decorative pieces.

7. The use of LiTracon is beneficial for protecting over mother earth.

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