Experimental studies on Strength and Durability properties of Transparent concrete

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Abstract The transparent concrete mainly concentrates on transparency and its aim is to attain the artistic finish and to generate the green technology. Transparent concrete is mainly "the mixture of optical fibres and fine concrete". Nowadays, green building mainly focuses on saving energy with indoor thermal systems. Therefore, it is important to introduce a new working material to serve the purpose of the structure in terms of safety (such as damage detection, fire warning), protection of environment, energy saving and artistic modelling. Nowadays, the space between buildings is reduced due to globalization and the construction of high-rise buildings, this leads to increase in the use of non-renewable energy sources, thus, and there is a requirement of new construction technique like green building and indoor thermal system. In 2001, the Hungarian architect Aron Losonczi invented the concept of transparent concrete at the Technical University of Budapest, and the first transparent concrete block was favourably produced by adding large amount of glass fibre into concrete in 2003, named as LiTraCon. In the present paper, the experimental study on strength and Durability properties of transparent concrete with 2.5% and 4% plastic optical fibre and the results are compared with conventional concrete.

***Keywords* —Transparent concrete, Plastic Optical Fibre, Compressive strength, Split tensile strength, Flexural Strength, Rebound hammer, Ultrasonic Pulse Velocity.**

I. INTRODUCTION

Concrete plays a very vital role in construction and has been used since roman times for development of infrastructure and housing. Due to rapid urbanization in 1960, concrete was often misconceived and disfavoured. But since that time, considerable progress has been made in concrete, not only in scientific terms but also in aesthetic terms. It is no more bulky, cold and grey material of the past; it has changed to attractive and lively. By research and innovation, newly established concrete has been designed which is more immune, light-weight, white or colored, etc. Translucent concrete (Transparent concrete)(6)(9) is an innovative concrete which is dissimilar from normal concrete. Transparent concrete permits light to pass through it and are light-weight as compared to normal concrete. The main aim of transparent concrete is to use sunlight as source of light in spite of using electrical energy in order to minimize the use of non-renewable sources. This technique results in to energy saving. Optical fibres are a detecting or transmission element, to reduce the use of non-natural light. The normal concrete is swapped by translucent concrete, which has natural lighting and art design. By introducing the concrete with optical glass fibres, light travels from outside in or inside out. Transparent concrete has the same strength as regular concrete and will continue to transmit light through walls up to twenty meters (twenty-two feet) thick.

Table 1.1: Characteristics of Transparent Concrete

Form	Prefabricated blocks
Ingredients	96% concrete, 4% optical fiber
Density	2100-2400 Kg/m2
Color	White, grey or black
Compressive strength	50 N/mm2
Bending tensile strength	7N/mm2

II. LITERATURE STUDY

Soumyajit Paul and Avik Dutta[5](2013) investigated a special type of concrete with light transmitting properties, to study their characteristics and developed a functioning material which is not only energy saving but gives out artistic finish. For obtaining transparent concrete, material comprises of mixture of polycarbonate and epoxy matrices as well as glass fibres, optical fibres, colloidal silica, silica and diethylenetriamine (DETA) and Portland cement. The content of the component is: epoxy matrix from 0% to 90%, and the polycarbonate matrix from 0% to 10%, colloidal silica sol from 0.5% to 5%, fiberglass from 0% to 10%,

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silica from 0.5% to 10%, diethylenetriamine (DETA). The ratio of the polymer matrices and the mortar is at least 1.5:1, and the mixing is done manually or mechanically. Maximum water absorption range is within 0.35%. This invention has greater mechanical strength properties as compared to the standard concrete, with lower density and mechanical characteristics that enable same to be used in both structural and architectural manner. This paper concluded that the transparent concrete has good light guiding properties and the ratio of optical fibre volume to concrete is proportion to transmission. This concrete does not lose the strength parameter when compared to regular concrete and also it has very vital property for the aesthetical point of view.

Jadhav et al (2016) replaced fine aggregate by waste toughen glass as 5%, 15%, 25% and 35% by weight for M30 mix design. As glass is a major component of solid waste stream, it is cheaper and can be found in many forms including container glass, glass door, vertical window, furniture, bathroom, etc.(6)(7)(10). The concrete specimen was tested for compressive strength and the results obtained were compared with those of normal concrete. The partial replacement of fine sand by waste toughen glass gives best result at 25% replacement of fine sand by waste toughen glass. The strength of glass concrete has increased by 7% at 25% partially replacement of fine sand by waste toughen glass as compare to conventional concrete. It has observed that the crack width goes on increasing over the 25% replacement of the waste toughen glass in concrete. It also reduces the total cost of the project.

In the present paper, the experimental study on strength and Durability properties like workability, non-destructive tests, compressive, split tensile and flexural strength tests and also water permeability test in durability criteria of transparent concrete with 2.5% and 4% plastic optical fibre is done and the results are compared with conventional concrete.

III. MATERIALS USED

A. WATER

Potable water from local resources was used for mixing and curing. Laboratory taps were used for concrete production. Water is the most important but the least expensive ingredient of concrete. A part of mixing water is utilized in the hydration of cement to form the binding matrix and the remaining water acts as a lubricant to make the concrete readily place able.

B. CEMENT

Ordinary Portland cement used in this study is Ultratech Cement (53 Grade) conforming to bureau of Indian Standards (IS 8112:1989) and IS12269:2013(1) .The cement is fresh and uniform colour, consistency and free from lumps and foreign matter. The cement was tested for various properties as per IS 8112-1989.

Table 3.1 Properties of Cement

S.No	Property	Values
1	Standard Consistency	32%
2	Initial setting time	162 minutes
3	Final setting time	235 minutes
4	Specific Gravity	3.14
5	Fineness	3.24%

C. COARSE AGGREGATE

The coarse aggregate forms the main matrix of this concrete. The retained material on IS 4.75 mm sieve is termed as coarse aggregate. The most commonly used coarse aggregate in concrete is crushed stone and gravel. Aggregate should be hard, angular and should have good crushing strength. Angular aggregate are used which will have good interlocking effect and high bond strength. In this investigation crushed stone was adopted as coarse aggregate. Coarse aggregates used in this study were of 10mm nominal size and having specific gravity of 2.79. They were tested as per Indian Standard Specifications IS: 383-1970(2) and IS 2386-Part3.

Table 3.2 Properties of Coarse Aggregate

S.No	Property	Value
1	Water Absorption	0.59%
2	Specific Gravity	2.79
3	Bulk Density i)Loose state ii)Compacted state	 1509.51Kg/m^3 1751.70Kg/m^3

D. FINE AGGREGATE

Locally available river sand with a 4.75 mm maximum size confirming to grading zone – II of IS 383-1970(2) has been used as fine aggregate. The aggregate is clean, inert and free from organic matter. Recommended IS Code for finding the properties is IS 2386 Part 3.

Table3.3 Properties of Fine Aggregate

S.No	Property	Value
1	Fineness Modulus	2.89
2	Specific Gravity	2.68
3	Bulk Density i)Loose state ii)Compacted state	 1503Kg/m^3 1688.29Kg/m^3

E. PLASTIC OPTICAL FIBRE

An Optical Fibre is a flexible, transparent fibre made of glass (silica) or plastic, slightly thicker than a human hair. It functions as a waveguide or light pipe, to transmit light between the two ends of the fibre. In this present study, 0.75mm plastic optical fibre is used.

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Table 3.4 Properties of fibre

Product	Fibre Diameter (mm)	Fibre Diameter (inches)	Attenuation db/m (650nm	Numerical Aperture	Allowable bending radius
FOF.25	0.25	1/100th	<0.35	0.5/0.6	>9mm
FOF.50	0.50	1.25/64th	Under 0.25		
FOF.75	0.75	1.9/64th	Under 0.20		
FOF1.0	1.0	1.25/32nd			
FOF1.5	1.5	1/16th			>20mm
FOF2.0	2.0	5/64th			
FOF3.0	3.0	1/8th			

IV. METHODOLOGY

The thesis was designed as per IS 10262-2009[3] mix was designed for transparent concrete of M25 grade and conventional concrete in the present study. Wooden moulds with plastic optical fibre were shown in Figs. 4.1 and 4.2. The cylinder specimens were prepared using Poly Vinyl Chloride (PVC) pipes as shown in Fig.4.3. The number of holes that were drilled to the wooden and PVC specimens are presented in Table 4.1. The transparent concrete is attained when the fibres are passed through the holes of the specimens in required percentages and mix proportions are added with usage of only 10mm aggregate. The fresh and hardened properties of transparent concrete such as Slump flow test, Compressive strength, Split tensile strength, Flexure strength, Rebound hammer and Ultrasonic Pulse Velocity tests were carried out. The strength parameters were studied at the ages of 7 and 28days respectively also considering IS 456:2000[4]. The transparent concrete cube after casting is shown in Fig.4.4.

Eighteen cubes, eighteen cylinders and eighteen flexural beams were cast for the 3 types of mixes i.e. conventional concrete, transparent concrete with plastic optical fiber in proportions of 2.5% and 4%. A total of 54 cubes, 54 cylinders and 54 prisms were cast which include specimens cast for conventional concrete mix and for transparent concrete.

The mix design of M25 concrete grade was carried out in proportion of 1:3.57:2.092 with a w/c ratio of 0.47.

Fig.4.1 Cube Specimens for transparent concrete

Fig.4.2 Wooden prism with plastic optical fibre

Fig.4.3 Cylinder (PVC) with plastic optical fibre

Table 4.1 Number of needles to the transparent concrete mould specimens

Type of Specimen	Number of Needles	
	2.5%	4%
Cube	80	127
Cylinder	63	100
Prism	90	142

Fig.4.4 Transparent concrete after been cast

V. EXPERIMENTAL INVESTIGATION

5.1 Tests on Fresh concrete:

A. *Workability: (IS: 1199-1959)*

Workability is defined as the ease with which concrete can be placed. It is the property of concrete which determines the amount of useful internal work necessary to produce full compaction. Slump test was done to measure the workability of concrete mix.

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Fig.5.1 Slump cone test

5.2 Tests on hardened concrete:

A. Compressive strength: (IS 516-1959)

Compressive strength tests were conducted in accordance with IS: 516–1956 on a 2000Kn compression testing machine. The bearing surfaces of the machine were cleaned and the test specimen was placed in the machine such that the load was applied to the faces other than the cast face of the specimen. The maximum compressive load on the specimen was recorded as the load at which the specimen failed to take further increase in the load. The average of three specimens was taken as the representative value of compressive strength for each mix. The compressive strength was calculated by dividing the maximum compressive load by the cross-sectional area of the cube specimen over which the load was applied.

The compressive strength is found by using formula as shown below:
Compressive strength = load/area (N/mm^2)

Fig.5.2.1 Compressive strength test

B. Split tensile strength: (IS 5816-1999)

Fig.5.2.2 Split tensile strength

The Split tensile strength was conducted on compression testing machine by placing the specimen diagonally. The split tensile strength was determined using formula

$$F_t = \frac{2P}{\pi x D x L} \text{ N/mm}^2$$

Where,
P= Maximum load in kN applied to the specimen
D= Cross sectional dimension of cylinder on which load is applied
L= Length of specimen in mm
F_t= Split tensile strength, N/mm^2

C. Flexure strength: (IS 516-1959)

The flexure strength of concrete is calculated using the expression

$$F_b = \frac{pl}{bxdxd} \text{ N/mm}^2$$

Where
F_b= Flexural strength, N/mm^2
P= maximum load in kN applied to the specimen
L= Length in mm of the span on which the specimen was supported
b= width of the specimen
d= depth of specimen

Fig. 5.2.3 Flexure strength test

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Fig. 5.2.4 Flexure pattern

5.3 Non-destructive tests on concrete:

A. Rebound hammer: (IS: 13311 part- 2 1992)

Rebound Hammer test is a Non-destructive testing method of concrete which provide a convenient and rapid indication of the compressive strength of the concrete. When the plunger of rebound hammer is pressed against the surface of concrete, a spring controlled mass with a constant energy is made to hit concrete surface to rebound back. The extent of rebound, which is a measure of surface hardness, is measured on a graduated scale. This measured value is designated as Rebound Number (rebound index)

Table5.3.1 Quality of Concrete for different values of rebound number

Average Rebound Number	Quality of Concrete
> 40	Very Good Hard Layer
30 to 40	Good Layer
20 to 30	Fair
< 20	Poor Concrete
0	Delaminated

B. Ultrasonic Pulse velocity: (IS: 13311 part 1-1992)

Ultrasonic pulse velocity method consists of measuring the time of travel of an ultrasonic pulse, passing through the concrete. This test is done to assess the quality of concrete by ultrasonic pulse velocity method as per IS: 13311 (Part 1) – 1992. Comparatively higher velocity is obtained when concrete quality is good in terms of density, uniformity, homogeneity etc.

Table 5.3.2 Limits of Ultrasonic Pulse velocity values

Pulse Velocity (km/second)	Concrete quality (grading)
Above 4.5	Excellent
3.5 to 4.5	Good
3.0 to 3.5	Medium
Below 3.0	Doubtful

Fig. 5.3.1 Ultrasonic pulse velocity test

5.4 Durability test on concrete:

A. Water Permeability:

Basic procedure of such a test is to apply water under pressure to one surface of the specimen for a specific time and then split the specimen perpendicular to the injected face and determine visually the depth of penetration. The test is carried out according to German Standard DIN 1048 on concrete specimens of size 150x150x150 mm, at an age of 28 days. The test cell assembly being used had the provision for testing six cubes at a time. Once the specimens were assembled in the test cells, a water pressure of 500 KPa (5 bar) was applied for 72 hours. Water pressure is applied by means of an arrangement consisting of a water tank connected to an air compressor through a valve, to adjust the pressure.

Fig.5.4 Water permeability test specimens

VI. RESULTS AND DISCUSSIONS

A. Workability:

The workability of concrete is determined by slump cone test. While casting the specimens only the workability is measured, if any mix does not have required slump of 25-75mm then the mix would be made again with plasticizer. The tests were conducted on M25 grade concrete. In accordance with workability the percentage of admixture required for low workable mixes to make their slump reach 25-75mm is also determined. The values of slump cone test obtained are tabulated in Table 6.1. The results are graphically presented in Fig.6.1 for M25 grade concrete. It

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is observed that as the percentage of the replacement of plastic optical fibre increases, the slump increases.

Table6.1 Slump cone test results

Type of Concrete	Conventional	Transparent (2.5%)	Transparent (4%)
Slump(mm)	35	39	43
Percentage of admixture require for slump (25-75mm)	0.8%	0.8%	0.8%

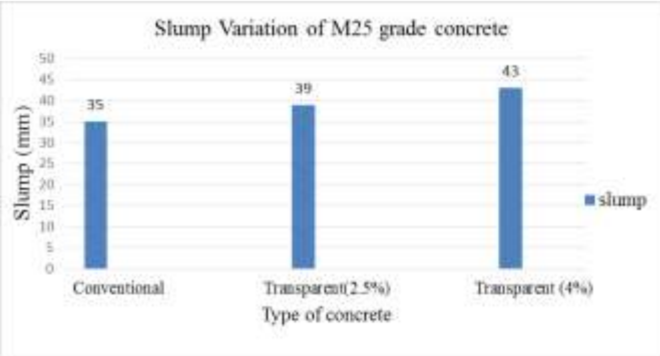

Fig.6.1 Variation of slump of M25 grade concrete

B. Weight of specimens:

The weights of cube specimens are checked and were presented in Table6.2 below

Table 6.2 Weight of cube specimens

Conventional Concrete (kg)		Transparent Concrete 2.5% (kg)		Transparent Concrete 4% (kg)	
7 days	28 days	7 days	28 days	7 days	28 days
8.97	8.95	8.15	8.13	8.35	8.48
8.96	8.87	8.38	8.43	8.56	8.75
9.07	9.04	8.26	8.36	8.44	8.39

From the Table6.2, it is observed that, the weight of transparent concrete is less than the conventional concrete. As the addition of plastic optical fibre increases, the weight of transparent concrete increases. The weight of transparent concrete specimens made with 4% plastic optical fibre is 2.3% more than transparent concrete specimens made with 2.5% plastic optical fibre. The decrease in weights of transparent concrete cubes with 2.5% plastic optical fibres is of order 9.14% and 9.16% when compared to conventional concrete cubes at 7 and 28days respectively. Similarly, the decrease in weights of transparent concrete with 4% plastic optical fibre is of order 6.91% and 5.25% when compared to conventional concrete at 7 and 28days respectively. From the above results, it is observed that the decrease in weights is mainly due to usage of plastic optical fibre, thus indicating transparent concrete is a light weight material.

C. Compressive strength:

The comparison of values of compressive strength of transparent concrete with conventional concrete of M25 grade at 7 and 28days are presented in Table6.3 and in Fig.6.3 below.

Table6.3 Compressive strength of M25grade of concrete

Compressive Strength (N/mm^2)			
Age (days)	Conventional concrete	Transparent concrete – 2.5% POF	Transparent concrete – 4% POF
7	27.55	29.23	30.25
28	37.9	38.89	41.71

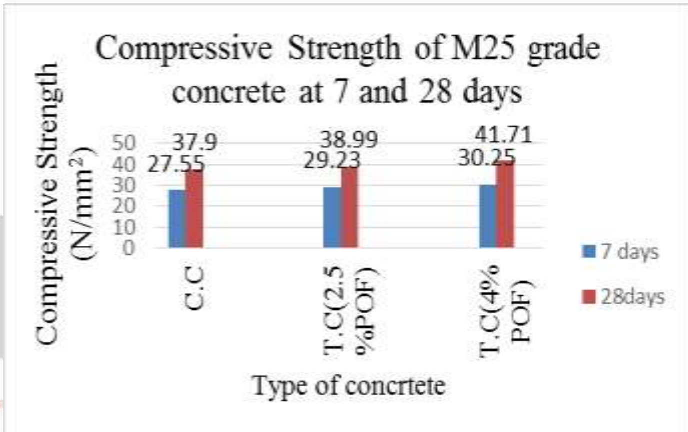

Fig.6.3 Compressive strength of M25grade concrete at 7and 28 days

From the Table6.3 and Fig6.3, it is observed that the increase in compressive strength of transparent concrete is observed when compared to conventional concrete at all ages. The transparent concrete with 4% plastic optical fibres shown more compressive strength than conventional concrete (M25 grade) at 7 days and 28 days when compared to concrete with 2.5% optical fibre and conventional concrete. The compressive strength of transparent concrete with 2.5% plastic optical fibre is of order 6.09% at 7 days and 2.61 % at 28 days when compared to conventional concrete. Whereas for transparent concrete with 4% plastic optical fibre, the values of compressive strength are of 9.81% at 7 days and 10.05% at 28 days when compared to conventional concrete. Hence, as the addition of plastic optical fibre increases, compressive strength of specimens increases.

D. Split tensile strength:

The test has been conducted on cylinders of size 150mm x 300mm for all mixes and resulting split tensile strength obtained at the age of 7 and 28 days of M25 grade concrete. The comparison of values of split tensile strength of transparent concrete with conventional concrete of M25 grade at 7 and 28 days are presented below in Table6.4and in Fig.6.4.

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Table6.4 Split tensile strength of M25 grade of concrete

Split tensile strength (N/mm^2)			
Age (days)	Conventional Concrete	Transparent Concrete – 2.5%	Transparent Concrete – 4%
7	1.92	2.23	2.58
28	3.48	3.65	3.89

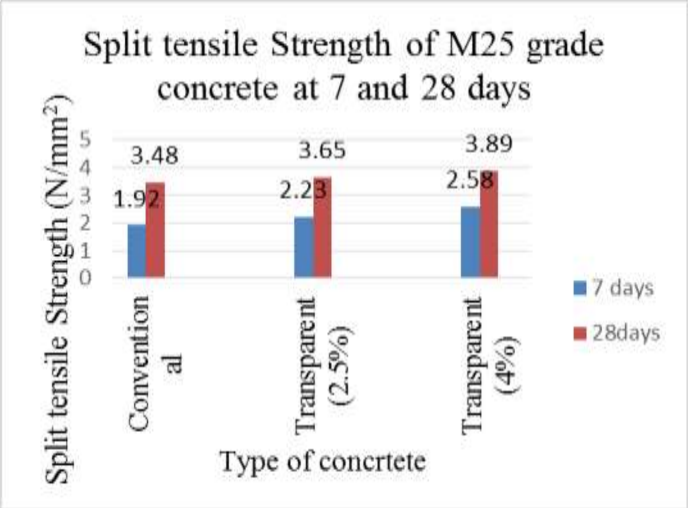

Fig.6.4 Split tensile strength of M25 grade concrete at 7 and 28 days

From Table6.4 and Fig6.4, the split tensile strength of transparent concrete with 2.5% plastic optical fibre is of order 16.14% at 7 days and 4.65 % at 28 days when compared to conventional concrete. Whereas for transparent concrete with 4% plastic optical fibre, the values of split tensile strength are of 34.36% at 7 days and 11.28% at 28 days when compared to conventional concrete. Thus, as the addition of optical fibre increases, the split tensile strength of specimens increases. It is observed that the increase in split tensile strength of transparent concrete is observed when compared to conventional concrete at all ages. The transparent concrete with 4% plastic optical fibres shown more split tensile strength than conventional concrete (M25 grade) at 7 days and 28 days when compared to concrete with 2.5% optical fibre and conventional concrete.

E. Flexure strength:

Flexural strength test has been conducted on beams of size 500mm x 100mm x 100mm for all mixes and resulting flexural strength obtained at the age of 7 and 28 days of M25 grade concrete. The comparison of values of flexural strength of transparent concrete with conventional concrete of M25 grade concrete at 7 and 28 days were presented below in Table6.5and Fig.6.5.

Table6.5 Flexure strength of M25 grade of concrete

Flexure strength (N/mm^2)			
Age in days	Conventional concrete	Transparent concrete-2.5% POF	Transparent concrete-4% POF
7	4.18	4.43	4.67
28	6.48	6.64	6.89

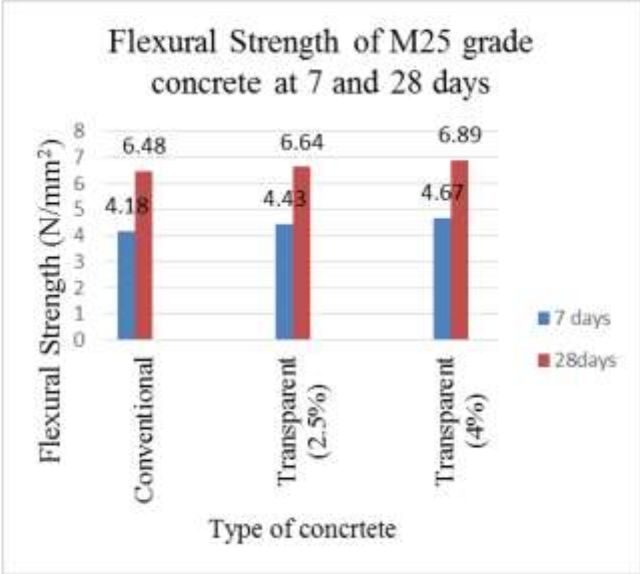

Fig.6.5 Flexure strength of M25 grade concrete at 7 and 28 days

From the Table6.5 and Fig.6.5, it is observed that the increase in flexural strength of transparent concrete is observed when compared to conventional concrete at all ages. The transparent concrete with 4% plastic optical fibres shown more flexural strength than conventional concrete (M25 grade) at 7 days and 28 days when compared to concrete with 2.5% optical fibre and conventional concrete. The flexural strength of transparent concrete with 2.5% plastic optical fibre is of order 5.98% at 7 days and 2.46 % at 28 days when compared to conventional concrete. Whereas for transparent concrete with 4% plastic optical fibre, the values of flexural strength are of 11.72% at 7 days and 6.32% at 28 days when compared to conventional concrete. Thus, as the addition of optical fibre increases, the flexural strength of specimens increases.

F. Rebound hammer:

The variations of values where the tests were conducted for both 7 and 28 days cubes were presented in Table 6.6 and Fig6.5. A concrete with low strength and low stiffness will absorb more energy to yield in a lower rebound value.

Table6.6 Rebound hammer test results

Rebound Hammer (N/mm^2)			
Age (days)	Conventional Concrete	Transparent Concrete 2.5% POF	Transparent Concrete - 4% POF
7	21.76	37	38
28	18.33	39	36

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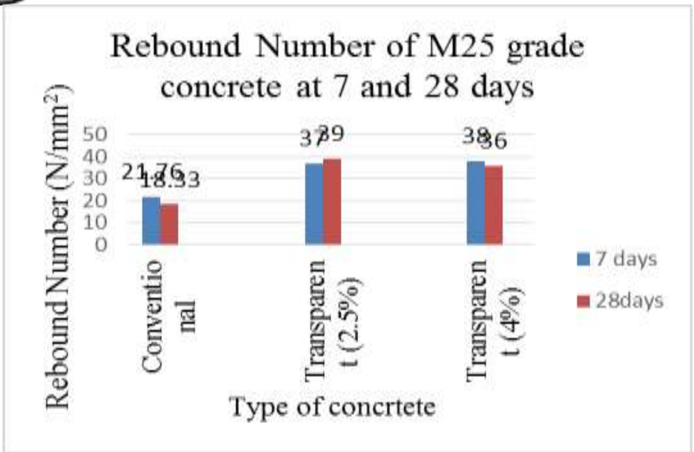

Fig.6.6 Rebound hammer of M25grade concrete at 7 and 28 days

It is observed that from the Table6.6 and Fig 6.6 that the values of rebound hammer for transparent concrete with 2.5% and 4% plastic optical fibre are observed to be good when compared to conventional concrete. At 28 days, the transparent concrete made with 2.5% and 4% plastic optical fibre are having values between 30-40 indicating the good concrete. Whereas conventional concrete shown not much good results, indicating the quality of concrete is fair.

G. Ultrasonic Pulse velocity:

The quality of concrete in terms of uniformity, incidence or absence of internal flaws, cracks and segregation, etc. indicate the level of workmanship employed, and thus can be assessed using the guidelines given below in Table6.7 and in Fig.6.7, which have been evolved for characterizing the quality of concrete in structures in terms of the ultrasonic pulse velocity.

Table6.7 Ultrasonic Pulse velocity test results

Ultrasonic Pulse velocity (km/s)			
Age (days)	Conventional Concrete	Transparent Concrete 2.5%	Transparent Concrete 4%
7	4.74	4.34	4.69
28	4.75	4.56	4.52

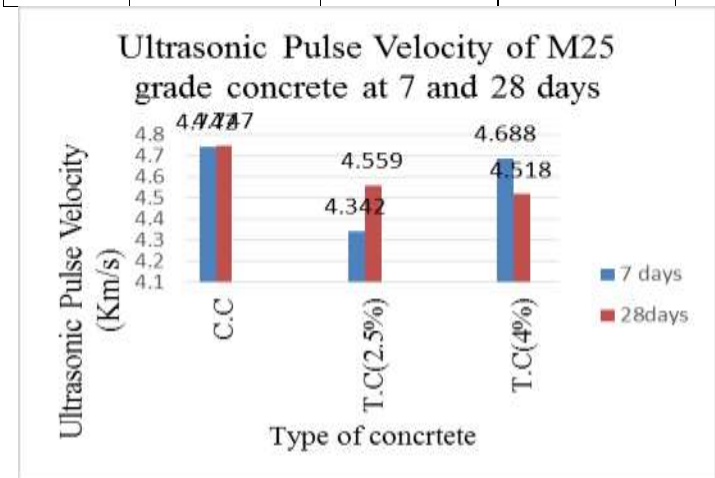

Fig.6.7 Ultrasonic Pulse velocity of M25grade concrete at 7 and 28 days

The Ultrasonic Pulse Velocity test conducted on conventional concrete and transparent concrete made with 2.5% and 4% plastic optical fibre are shown good values indicating that quality of concrete is good . The Ultrasonic Pulse Velocity values obtained for transparent concrete made with 2.5% and 4% plastic optical fibre are more or less similar to conventional concrete.

H. Water permeability:

The water permeability tests are the best for evaluating concrete durability under hydrostatic pressure. The smaller the depth of penetration results in a higher resistance to water pressure. For a dense and low-permeable mix, the depth of water penetration is low, making it difficult to compare the mixes that have low permeation. In all, concrete permeability is a good indicator of its quality and durability, but more is needed to determine an accurate calculation. The focus of testing for durability should put the most weight on determining concrete's permeability, resistance to environmental factors, and tendency to crack.

Permeability (mm)			
Age (days)	Conventional Concrete	Transparent Concrete 2.5%	Transparent Concrete 4%
7	57	23	69.33
28	71	54	75

Table6.8 Water permeability test results

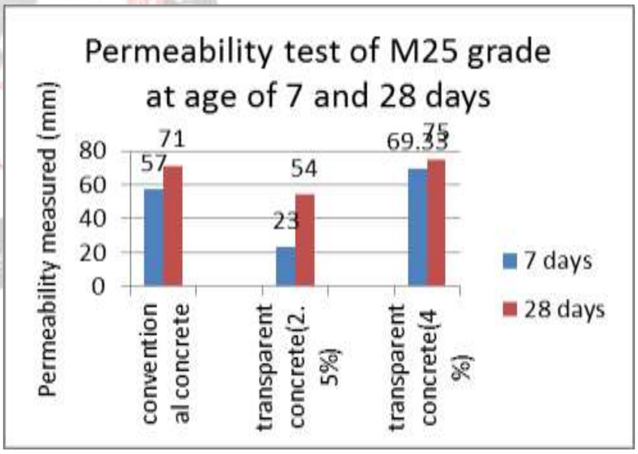

Fig.6.8 Water permeability test of M25 grade at age of 7 and 28 days

The transparent concrete specimens with 4% plastic optical fibre are showing more permeability values when compared to conventional concrete and transparent concrete with 2.5% plastic optical fibre at ages 7 and 28days respectively as observed from the Table6.8 and Fig.6.8. Hence the transparent concrete with 4% optical fibre is more durable when compared to transparent concrete made with 2.5% plastic optical fibre and conventional concrete.

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VII. CONCLUSIONS

Results were analyzed to drive useful conclusions regarding weight, workability, strength, durability of transparent concrete with 2.5% and 4% of plastic optical fibre fraction and conventional concrete for M25 grade. The following conclusions are drawn from the study

1) Workability of Transparent concrete shown higher slump values as the percentage of addition of optical fibres increases.
2) Slump of transparent concrete with 4% plastic optical fibre is more by 8% compared to conventional concrete and 4% compared to transparent concrete with 2.5% plastic optical fibre resulting in higher workability.
3) The decrease in weights of transparent concrete cubes with plastic optical fibres of 2.5% and 4% when compared with conventional concrete cubes is of order 9.16% and 5.25% at 28 days respectively. Hence, transparent concrete is a light weight material.
4) The Transparent concrete with 4% plastic optical fibre achieved maximum compressive strengths at all ages when compared to conventional aggregate concrete.
5) Compressive strength of concrete increases with increase in percentage of plastic optical fibre used in concrete mixes. The compressive strengths obtained are more than target strengths and for 4% plastic optical fibre; it is slightly more than conventional concrete.
6) The compressive strength of transparent concrete made with 4% plastic optical fibre is increased by 2.61% at 28days when compared to transparent concrete with 2.5% plastic optical fibre and 10.05% when compared to conventional concrete. Thus, compressive strength parameter of transparent concrete is more compared to conventional concrete and can be used in various applications.
7) The increase in split tensile strength values is of order 4.65%, and 11.78% with 2.5% and 4% replacement of plastic optical fibre at 28 days respectively. Hence, the transparent concrete with 2.5% and 4% are giving better split tensile strengths compared to conventional concrete. The increase in split tensile strength of transparent concrete with 4% plastic optical fibre is mainly due to increase in bond between the optical fibres.
8) Transparent concrete with 4% replacement of optical fibre shown better flexural strengths compared to conventional concrete. The flexure strengths are 6.32% and 2.46% at 28days for transparent concrete with 2.5% and 4% fibre fraction respectively. Transparent concrete is not only used as a decorative material but can also be used in major constructions involving flexure.
9) The test results obtained from non-destructive testing are in agreement with the results of conventional concrete as values obtained for transparent concrete are similar to conventional concrete.
10) The Ultrasonic Pulse velocity values of transparent concrete with 2.5% and 4% plastic optical fibre shown good values when compared to conventional concrete, indicating quality of concrete and homogeneity obtained is good.
11) The transparent concrete with 2.5% and 4% optical fibre shown better values of hammer compared to conventional concrete by conducting rebound hammer test. The quality of concrete is observed to be good.
12) Durability of transparent concrete with 4% optical fibre is more by 5.63% when compared to conventional concrete and by 28% when compared to transparent concrete with 2.5% plastic optical fibre by conducting water permeability test.

Thus, the conclusions indicate transparent concrete can be used in various applications irrespectively on par with conventional concrete.

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