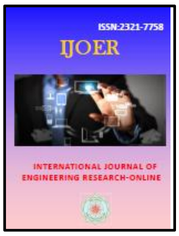
International Journal of Engineering Research-Online
A Peer Reviewed International Journal
Articles available online http://www.ijoer.in; editorijoer@gmail.com
Vol.5., Issue.4, 2017
July-August

RESEARCH ARTICLE

ISSN: 2321-7758

THE STUDY ON TRANSLUCENT PANELS AND BRICKS

M.PRAVEEN KUMAR[1], L.INDUMATHI DEVI[2]
[1]Assistant Professor, Civil Engineering Department, Visvodaya Engineering College, Kavali
[2]M.Tech Student, Civil Engineering Department, Visvodaya Engineering College, Kavali



ABSTRACT
It is used in fine architecture as a facade material and as a cladding for interior walls. To integrate the merits of the concrete and Translucent concrete. Light is conducted through the stone from one end to other end therefore fibers has to go through the whole object. Translucent concrete is also known as transparent concrete because of its properties optical fibers concrete is a building material depends on the transparent property. The Light transmissive property is due to the optical fibers embedded for developing translucent concrete by arranging the high numerical aperture optical fibers (OPF)or bigger diameter glass optical fibers in concrete. the main purpose is to use sunlight as a light source to reduce the power consumption as illumination and to use the optical fibers to sense the stresses of the structures and also to provide good aesthetical view of the building.

1. INTRODUCTION

1.1 CEMENT: Cement is the binding material used in many constructions. Cement is not used directly because it has rocky nature in wet condition so it is mixed with sand compulsory. Cement is mixed with sand and gravel is called concrete. Cement has more cost compare to some admixtures like fly ash so cement is replaced with fly ash in some times. For the manufacturing and transporting of cement high energy consumption is required and also causes the air pollution including the release of greenhouse gasses like CO_2, dioxin, NO_x, SO_2, and particulates which concerns the environment. Cement is known that in construction materials, the most versatile is concrete, which is available in the world.

1.2 SAND: Sand is composed of finely divided rock and mineral particles. Sand is finer than gravel. Sand is available in various places those are in hilly areas and in rivers and in canals, in some special places.As per the Indian standards the zone obtained is zone-II by conducting dry sieve analysis.

Table 1: Fineness modulus of sand

I.S. Sieve designation	% of passing as per IS (zone II)	% of passing (obtained)
10mm	100	100
4.75mm	90-100	95.88
2.36mm	75-100	88.4
1.18mm	55-90	68.6
600 micron	35-59	35.7
300 micron	30-Aug	12.6
150 micron	0-10	4

1.3 OPTICAL FIBRE: An Optical fibre is a thin cylindrical shape. The optical fibre allows the light and the transmission is totally internal reflection and emit the light out. An Optical fibre allows light waves with less energy to travel long distance. Optical fibre consists of high refractive index core made of plastic or glass. A lower refractive index surrounding the core called as cladding which is covered from moisture and abrasion by a jacket. The light travelling through thin glass centre is called core. As optical fibre is of transparent dielectric, the light undergoes total internal reflection. Optical fibre is also a wave guide.

CLASSIFICATIONS OF OPTICAL FIBRES:

Optical fibers are classified in to 3 types on the basis of refractive index profile and number of modes. They are:

1. Step index- single mode fiber
2. Step index- multi mode fiber
3. Graded index –multi mode fiber

From the above the first one step index-single mode fiber has core diameter 5-10µm. The light ray transmission is the only possibility by the core diameter. 80% of fibers are manufactured in the world today are of index single mode type.

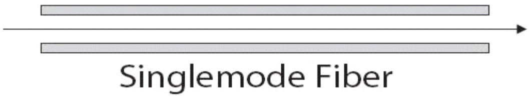


Fig. 1: Step Index Single Mode Fibre

The core diameter and external diameter cladding of the step index multimode fibre is 50 to 200µm and 125 to 300µm. The value of refractive index is suddenly decreased from core to cladding because the cladding material is lesser and core material is of uniform refractive index. If the core has larger diameter, propagation of many modes within the fibre is allowed.

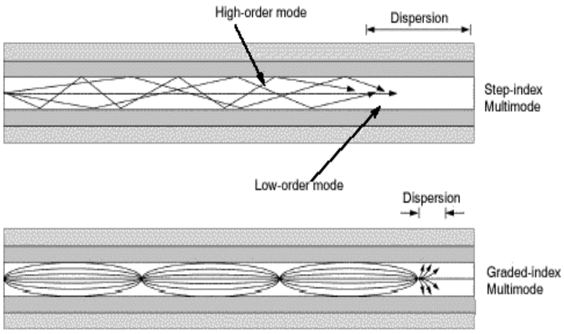


Fig. 2: Step Index Multimode Fibre

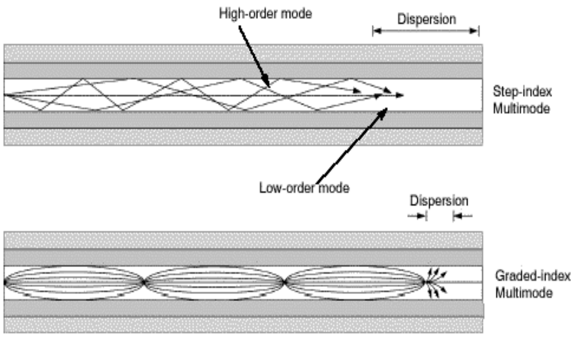


Fig.3: Graded Index Multimode Fibre

The refractive index maximum at the axis and decreases towards the cladding in graded index-multimode fibre. As we observed that there is a gradual decrease in the refractive index and the modal dispersion can be minimized by the following.

The principle behind the transmission of light waves is a total internal reflection. The below explanation about the total internal reflection in the walls of the fibre:

- Higher refractive index (n_1) must be maintained to the glass around the centre of the fibre than that of material surrounding the fibre (n_2).
- The critical angle smaller than light should incident at an angle (between normal to the fibre wall and the path of the ray), θc.

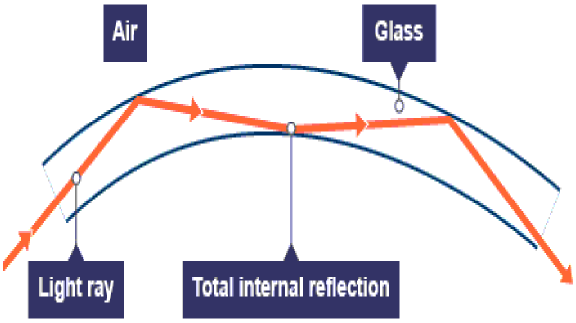


Fig. 4: Total internal Reflection

1.4. FLY ASH: Fly ash is taken from power plants. There are 70 thermal power stations in our India. Our country produces about 80 M.T. of coal ash per annum in various coal based thermal power stations. Environmental planner is facing greater challenges in preventing the degradation of environment and land being cost by dumps around thermal power stations all over India. A particle size below 10µ (microns) contributes towards early Development of strength. The particle size above 45 microns does not contribute towards development of strength even after 1 year and for all practical purpose they should be considered only as sand. The fly ash replacement from l0 to 30% increases the development of Strength up to 3 month or even more depending on the fineness of fly ash & its reaction with Calcium hydroxide released during primary hydration of cement. This means that the fly ash takes less water content based on concrete. Fly ash has limited replacement for sand is uneconomical and sometimes it is inevitable in pumping concrete especially when coarser types of fine aggregates are used in concrete mix.

Table 2: Physical Analysis of Fly Ash

Physical characteristics	**Typical characteristics of ash from V.T.P.S Ash**
Bulk density (kg/m^3)	1000
Specific gravity	2.1

Table 3: chemical analysis of Fly ash

Property	**Test results obtained from plant**
Loss on Ignition	0.63
Silica as SiO_2	59.04
Iron as Fe_2O_3	2
Aluminium as Al_2O_3	34.08
Sulphur Trioxide as SO_3	0.05
Calcium as CaO	0.22
Magnesium as MgO	0.43
Sodium as Na_2O	0.5
Potassium as K_2O	0.76

1.5 TRANSPARENT WALL: Transparent wall is a new technique from conventional wall. Transparent wall is a light weight and allow more glow comparing to conventional wall. It is partially visible the light from the outside to inside. It cannot allow the air in between both sides of the wall. Transparent walls are not used in normal construction so it is mainly used for decorative purpose.

1.6 TRANSPARENT LIGHT WEIGHR CONCRETE: In the concrete optical fibres consist only 4%, in this process as per the arrangement some light is transmitted because the matrix between to the two outer surfaces of each block. There is no effect on the strength so from this we also construct Load-bearing structures, because glass fibres have no negative effect on the strength of the concrete. The blocks constructed for this project are come in various proportions and with an option of enclosed heat-isolation. Light transmitting concrete creating light transmitting building blocks in other textures and colours as well so it is not all peoples appreciates the look of exposed concrete. It is also called as Translucent concrete.

It here and now explains the concept of light transmitting concrete in the form of applicable latest building material. By this concept the optical fibres in the concrete allows light and can be transmitted from the one end to another end of the fibre. The main target of this project is to use sunlight and produce light indoor to the building in order to lower the power consumption, because now a days the light is only artificial that exhausting the power. The mechanical performance like compressive strength, Split tensile strength and light transmission test is compared with the conventional concrete and translucent concrete. As references from literature review, the light transmitting concrete will be more strength by using optical fibre and less for glass rod in the concrete, hence from the observation we are taking optical fibre based on the volume of the cube by 0.15%, 0.25%, and 0.35%.

2. OBJECTIVES AND DETAILS OF PRESENT INVESTIGATION:

Step – I: Preparation of moulds with different sizes has 19 cm x 9 cm x 9 cm, 19 cm x 9 cm x 4.5 cm & 7.5 cm x 7.5 cm x 7.5 cm to the construction of translucent concrete blocks with different hole spacing's 0.5cm, 1cm & 2cm.

Step – II: To fix the optical fibre into the mould and tight it.

Step – III: Fill the cement paste to the concrete bricks and cubes.

Step – IV: Prepared normal concrete blocks and also prepared with replacement of fly ash concrete blocks in different percentages 5%, 10%, 15% & 20%.

Step – V: Prepared translucent concrete blocks and also prepared with replacement of fly ash concrete blocks in different percentages 5%, 10%, 15% & 20%.

Step – VI: Casting the blocks for 7 days and 28 days.

Step – VII: To determine the light transmitting test, compression strength and flexural strength for both normal & translucent bricks and cubes.

Step – VIII: Weight comparison between the normal and translucent blocks.

The detail of this project is when a light travels from denser to a rare medium such that the angle of incidence is greater than the critical angle; the angle reflects back into the same medium this phenomenon called total internal reflection. In the optical fibre sun light rays undergo repeated total number of reflections until it emerges out of the inner building that is other end of the fibre if the fibre is bent.

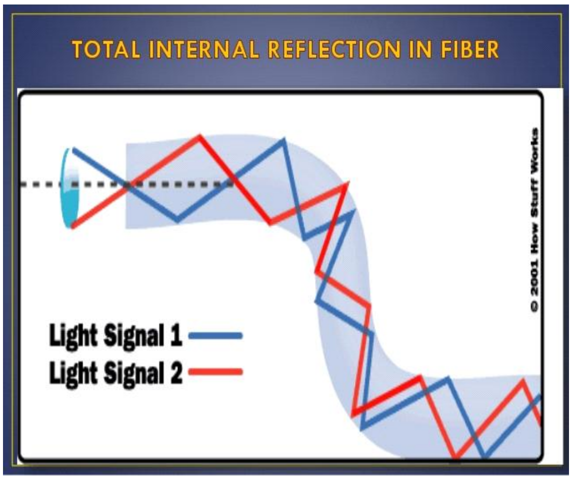


Fig.5: Fiber reflection

3.TESTS & RESULTS OF MATERIALS

3.1. CEMENT: There are various types of cement, however the most widely used cement in the U.S and in most parts of the world is Portland cement; it was developed by Joseph Aspdin, a British stone mason, in 1824.Portland cement is the common type of cement in general use. Ordinary Portland cement (OPC) of 53 grade was used in which the composition and properties is in compliance with the Indian Standard Organization. Cement is continues to harden over time as long as there is water available for the components of the cement to form bonds with.

3.1.1PROPERTIES OF PORTLAND CEMENT: This was done by taking the reference of various standard books, journals and some standard codes as reference. Here our aim is to determine actual chemical composition of the sample provided by the company. The chemical analysis of Portland cement is listed in Table.

Table 4: Constituents of Cement

Sl. No.	Constituent	Percentage
1	CaO	64
2	SiO_2	22
3	Al_2O_3	4.1
4	Fe_2O_3	3.6
5	MgO	1.53
6	SO_3	1.9

The following are the laboratory tests which are carried on cement:

- Setting time test
- Fineness test
- Compression test

3.1.2 SETTING TIME TEST

Table.5:Etting time test

Sl. no:	Characteristics	Values obtained	Standard values
1	Normal consistency	33mm	33 to 35 mm
2	Initial setting time	35 min	Not be less than 30mins
3	Final setting time	562 min	Not be greater than 600min

3.1.3 FINENESS TEST: Fineness of cement is known by sieving it on standard sieve. The proportion of cement of which the grain sizes are larger than the specified mesh size is thus determined. Standard size of the sieve for the test is 90µm.

Fineness of the sample is 9 %.

3.1.4 COMPRESSIVE STRENGTH OF CEMENT

Fig.6:Compression test of cement

The average compressive strength of cement sample is found to be

At the end of 3 days of curing= (25.5+25.0+26)/3 = 25.5 N/mm^2

At the end of 7 days of curing= (35.6+36.8+36.4)/3= 36.7 N/mm^2.

3.2.SAND

3.2.1 SIEVE ANALYSIS:

Fig.7: Sieve Shaker

Table 6: Bulking of Sand

S.no	Sieve Size	Mass Retained (gms)	%Retained	% Passing	Cumulative % Retained
1	4.75	3	0.3	99.7	0.3
2	2.36	8	0.8	98.9	1.1
3	1.18	188	18.8	80.1	19.9
4	600µ	195	19.5	60.6	39.4
5	300µ	485	48.5	12.1	87.9
6	150µ	120	12	0.1	99.9
7	Pan	4.5		_	
				ΣF =	248.5

Modulus of fine aggregate = **ΣF**/100=2.48

3.2.2 CHARACTERISTICS OF SAND

Table.7: Characteristics of Sand

S. No	Characteristics	Value
1	Bulking	25%
2	Specific gravity	2.65
3	Water absorption	1.85%
4	Fineness modulus	2.485

4. MANUFACTURING PROCESS:

4.1. PREPARATION OF THE MOULD

Moulds of rectangular cross sections of the sizes 190mm*45mm*90mm, 190mm*90mm*90mm, and another mould of cubic size 70.5mm*70.5mm*70.5mm are made with wood or steel. The preparation of mould for translucent concrete is a challenging task for cubes why it becomes difficult means the insertion of the fibre is a challenging task. Insertion in the transverse direction makes it more significant for our results. Based on the adoption of the size of the optical fibres the holes are drilled on the two opposite side of the mould walls and the holes to insert the optical fibres are placed at regular intervals.

Fig.8: Mould Diagram

4.2 OPTICAL FIBRE

The optical fibres are cut carefully to the required size of mould. The commonly available diameters of optical fibres are .25 mm, .5mm, .75 mm, 1 mm, and 2 mm. The optical fibres cut according to the required dimensions of the mould. For effective transmission of light through the optical fibres the fibres has to be arranged in a series of pipes if the fibres are not straight there will be no effective transmission of light

Fig.9: Optical Fibre

4.2.1 FIXING THE FIBRES

The wooden or steel plates which optical fibres are allowed to pass through mould initially or otherwise it becomes difficult after fixing the fibres to the mould The fixing of fibres is a laborious and time consuming process. Apply the oil to the way to fix the mould is represented in the following figure.

Fig.10: Fixing the Fibres

4.3. CONCRETING

The thoroughly mixed concrete is poured carefully and slowly without causing much disturbances to the previously laid optical fibres. To avoid the formation of voids the concrete is agitated and filled in thinner and smaller layers with the help of vibrating tables.

The mix proportion that we adopted here is 1:2 then the placing of the concrete in between the fibres is difficult task for the project. The compaction should be proper to avoid voids in the block if not done properly the voids will reduce the strength of the concrete we will be not able to obtain the desired results. We may also use the vibrator for the purpose of compaction but take care it may leads to bleeding also.

Fig.11: Concreting the Mould

4.4. CUTTING AND REMOVING THE MOULD

By checking the thickness of the panel, outside if there are extra long fibres those must be cut to maintain equal size. After that remove the mould and the casted mould was kept undisturbed on the levelled platform. Then it was de moulded carefully from casting. Immediately after de-moulding, the cube specimens were marked by their respective identification mark/numbers then place it into the water then test it.

5. EXPERIMENTAL INVESTIGATION

5.1 LIGHT TRANSMITTING TEST

The source of light here was taken as 200 W incandescent bulbs, a resistance of 100 Ω was applied in the circuit and a uniform DC voltage of 2.5 V was kept between the circuits. To determine the total light we use a plywood box. In this arrangeme LDR is fixed in bottom and the light source is in top. After the arrangement the sample cube is placed and conduct the test

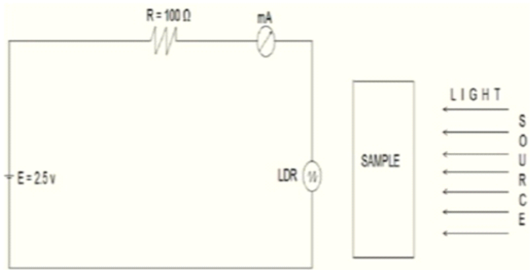


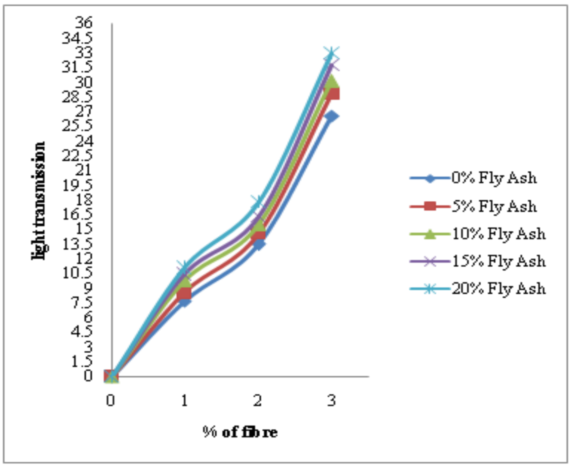
Fig.12: Circuit diagram

Light transmittance = 100 – [(A1−A2)/A1] x100 (2)

Using equation the amount of light transmittance is computed and on an average 50% light transmittance was obtained.

Table.8: Light transmission value for 7 days.

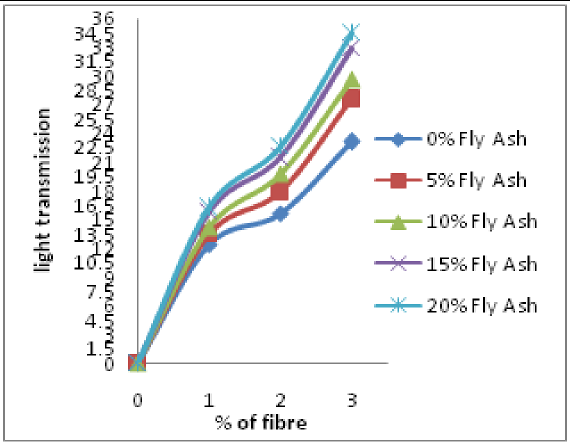
%Of Fly ash	% OF Fiber			
	0%	1%	2%	3%
0%	0	7.76	13.54	26.58
5%	0	8.6	14.64	28.91
10%	0	9.78	15.51	30.14
15%	0	10.45	16.38	31.76
20%	0	11.12	17.87	32.98



Graph.1: Light transmitting results for 7 days

Table.9: Light transmission value for 28 days.

%Of Fly ash	% OF Fibre			
	0%	1%	2%	3%
0%	0	12.46	15.67	23.14
5%	0	13.54	17.92	27.64
10%	0	14.27	19.81	29.69
15%	0	15.86	21.54	32.89
20%	0	16.29	22.62	34.56



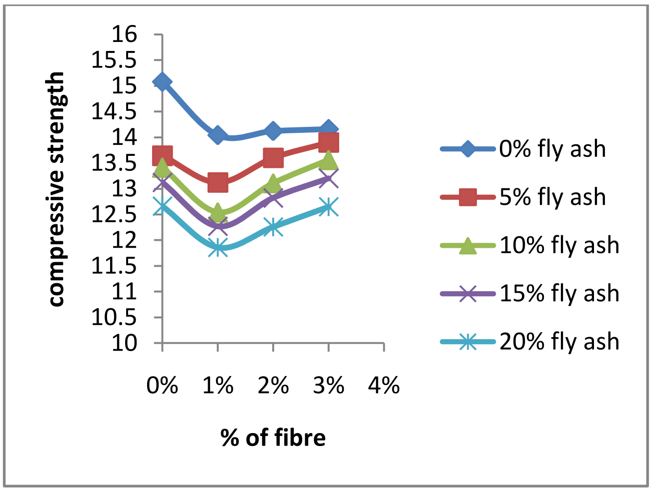
Graph.2: light transmitting results for 28 days

5.2 COMPRESSION STRENGTH TEST:

Fig.13: Compression Testing

Table.10: Comparison of compressive strength for 7 days

% of Fly ash	% of Fiber			
	0%	1%	2%	3%
0%	15.08	14.04	14.12	14.16
5%	13.64	13.12	13.6	13.9
10%	13.41	12.54	13.11	13.56
15%	13.12	12.27	12.82	13.2
20%	12.66	11.86	12.26	12.65



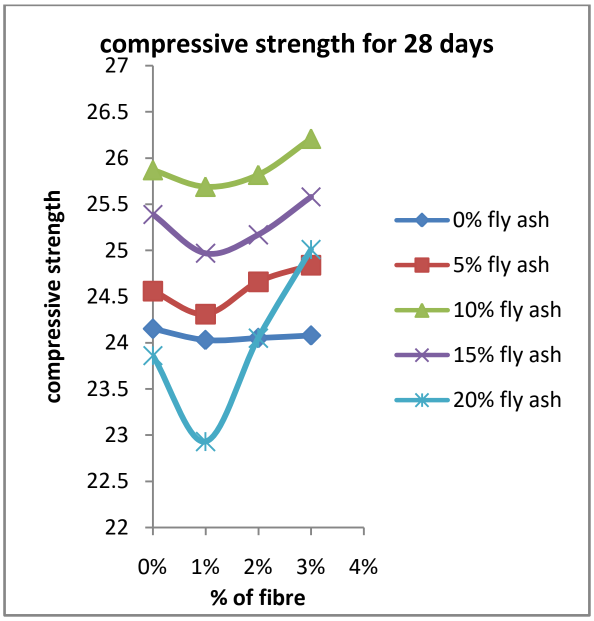
Graph.3: Comparison of Compressive strength for 7days

- The following chart represents the variation of the compressive strength with respect to normal block and translucent block.
- We know from this the difference between the two aspects there is a slight variation in the strength parameter of the translucent block but it almost reaches the value of normal concrete.
- These are the values that are obtained when cubes are tested in the compression testing machine it is very simple method by testing the load acting on the block then find the stresses acting on it.
- Thus it is very useful in case of the strength purpose as well as aesthetic view purpose most

probably it will far better results and better efficient structure.

Table.11: Comparison of compressive strength for 28 days

%Of Fly ash	% Of Fibre			
	0%	**1%**	**2%**	**3%**
0%	24.15	24.03	24.05	24.08
5%	24.56	24.31	24.66	24.84
10%	25.87	25.69	25.82	26.21
15%	25.39	24.97	25.17	25.58
20%	23.86	22.93	24.05	25.01



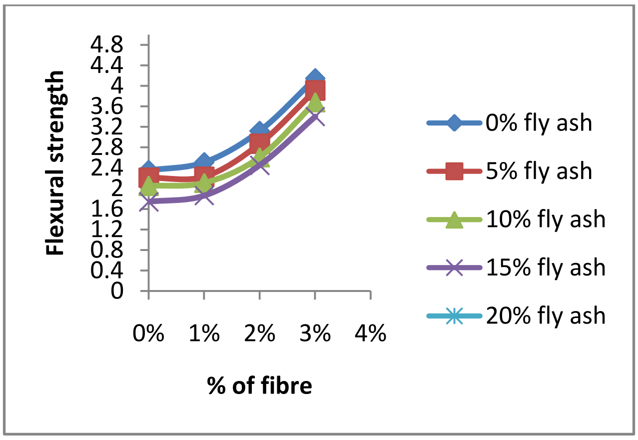
Graph.4: Comparison of compressive strength for 28 Days

- The following chart represents the variation of the compressive strength with respect to normal block and translucent block.
- We can signify the difference between the two aspects there is a slight variation in the strength parameter of the translucent block but it almost reaches the value of normal concrete.
- These are the values that are obtained when cubes are tested in the compression testing machine it is very simple method by testing the load acting on the block then find the stresses acting on it.
- Thus it is very useful in case of the strength purpose as well as asthetic view purpose most probably it will far better results and better efficient structure.

3. FLEXURAL STRENGTH TEST: The flexural strength parameters can be obtained as usual by taking the averages of the values.

Table.12: Comparison of Flexural strength for 7 days

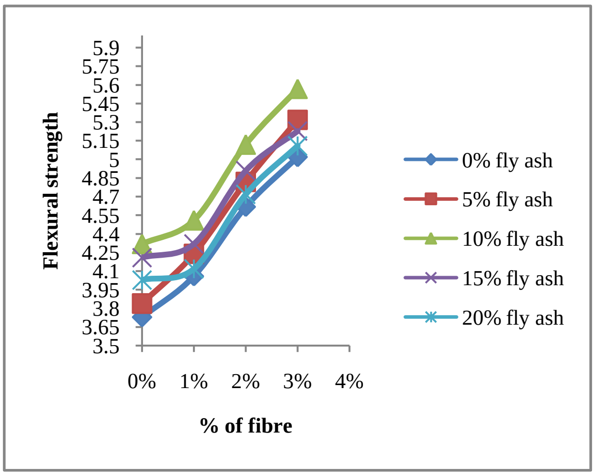
% Of Fly ash	% Of Fibre			
	0%	**1%**	**2%**	**3%**
0%	2.41	2.74	3.27	4.38
5%	2.35	2.51	3.12	4.14
10%	2.21	2.23	2.87	3.91
15%	2.05	2.11	2.61	3.68
20%	1.74	1.86	2.45	3.4



Graph.5: Comparison of flexural strength for 7 Days

Table.13: Comparison of Flexural strength for 28 days

% Of Fly ash	% Of Fibre			
	0%	**1%**	**2%**	**3%**
0%	3.73	4.06	4.62	5.02
5%	3.84	4.24	4.82	5.32
10%	4.32	4.51	5.12	5.57
15%	4.21	4.32	4.91	5.23
20%	4.03	4.12	4.72	5.11

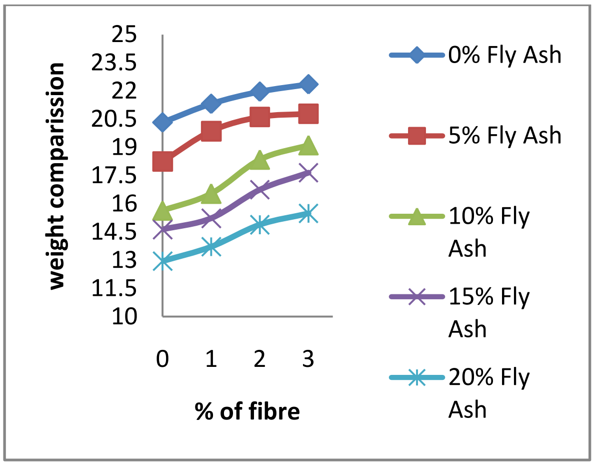


Graph.6: flexural strength for 28 days

5.3:WEIGHT COMPARISON

Table.14: Comparison of weights

%Of Fly ash	% of Fibre			
	0%	1%	2%	3%
0%	20.33	21.32	21.96	22.35
5%	18.25	19.86	20.62	20.79
10%	15.65	16.54	18.35	19.12
15%	14.63	15.23	16.75	17.65
20%	12.95	13.72	14.89	15.49



Graph.7: Weight comparison for normal and translucent concrete

6. CONCLUSIONS

Based on the experimental investigations on the light transmission, Compressive strength, flexural strength, weight comparison and considering the "environmental aspects" the following observations made regarding of optical fibres and fly ash added concrete

- The maximum light transmission is 49.35% and it obtained at the ratio of 3% fibre and 20% fly ash, or a curing period of 28 days.
- The ultimate compressive strength is 8.85% and it obtained at the point of 3% fibre and 10% fly ash, or a curing period of 28 days.
- The maximum flexural strength is 11.08% and it obtained at the ratio of 1% fibre and 10% fly ash, or a curing period of 28 days.
- The minimum weight comparison of concrete is 36.3 % and it obtained at the ratio of 2% fibre and 20% fly ash.

REFERENCES

[1]. A. akshaya b.kamdi, issn 2319 – 6009 www.ijscer.com, vol. 2, no. 3, august 2013, "transparent concrete as a green material for building".

[2]. B. Neha R. Nagdive and Shekhar D.Bhole (2013) ISSN (E): 2321-8843; ISSN(P): 2347-4599 Vol. 1, Issue 7, Dec 2013, 23-30, "To Evaluate Properties of Translucent Concrete/Mortar and Their Panels"

[3]. C. Jianping He et al (2011) "Study on Smart Transparent Concrete Product and Its Performances" ,proceedings of The 6th International Workshop on Advanced Smart Materials and Smart Structures Technology ANCRiSST2011 July 25-26, 2011, Dalian, China

[4]. D. M. N. V. Padma Bhushan (2013), "Optical Fibres in the Modelling of Translucent Concrete Blocks", ISSN: 22489622www.ijera.com, Vol.3, Issue-3, May-Jun-2013, pp.013-017(2013)

[5]. E. Prof.A.A.Momin(2014) "Study on Light Transmittance of Concrete Using Optical Fibers and Glass Rods", IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE) e-ISSN: 2278-1684, p-ISSN: 2320- 334X PP 67-72

LIST OF INDIAN STANDARDS REFERRED

[6]. IS:269-1958 specification for ordinary rapid-hardening and low heat Portland cement(revised and reprinted,aug.1965)

[7]. IS: 10262-1982, recommended guidelines for concrete mix design, 4th reprint, 1996.

[8]. Is: 456-2000, Indian standard plain and reinforced concrete code of practice, 4threvisio, 1st reprint/sep, 2000.

[9]. IS: 12269-1987 (reaffirmed1999), specification for 53 grade ordinary Portland cement, first reprints, September, 1993.

[10]. IS: 2386-1963 tests for a (all parts), method of aggregates for cement.

LIST OF TEXT BOOKS REFERRED

[1]. M.L. Gambier, Concrete Technology, Tata Mc Grill Publishing Company Ltd, Delhi.

[2]. M.s.setty" concrete technology" addition2005, s.chand&company limited, delhi, 1992.

[3]. N.krishnaraju, design of concrete mixes, 4th addition, 2002, cbspublishers and distributors, New Delhi.