A STUDY ON TRANSLUCENT CONCRETE

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ABSTRACT

The concrete presently used in the construction industry primarily consists of cement, water and aggregates. As we know, traditional concrete is greyish in colour, therefore its high density does not allow the light to pass through it. As it can be clearly visualized that translucent concrete will permit a friendly association between the environment and construction, thereby creating ambiences that are better and more naturally lit, at the same time as significantly reducing the expenses of laying and maintenance of the concrete. In addition to the translucent characteristics, the study gives an idea about the reinforcement method of this type of concrete such that this can be practically implemented as a load bearing structure. Thus this new innovation can help in enhancing the efficiency of green buildings, therefore making it an efficient inclusion of construction industry.

KEYWORDS: *BASF admixture, compressive strength, lux meter, optical fibre, self-compacting concrete, Translucent concrete, transmissibility*.

INTRODUCTION

The Hungarian architect Aron Lasonczi was a well knownauthor of the translucent concrete. He tried to create an architectural material allowing forming new, untypical arrangements by changing the concrete structure. The aim was juxtaposition of the two opposing concrete features: big mass and transparency – what creates concrete transmitting the light. Thanks to connecting concrete with properly placed plastic optical fibers it is possible to create a possible to overexpose wall, through which person and object contours from the other side can be seen. Shortly after that the idea of a translucent concrete was known not only in Hungary but also in many European countries like Germany, Italy and outside Europe – in China and India. Aiming at learning how the new material works, numerous experimentations were launched. Some modification attempts were made, not losing at the same time the most important concrete feature – transparency.

SCOPE AND OBJECTIVES

SCOPE

In current stages the translucent concrete is not widely produced. They can only be produced as precast blocks and wall panels. It cannot be poured on site like the conventional concrete. Generally the translucent concrete is used for decorative purpose.

1. Translucent concrete blocks can be used as building material for external and internal wall.

2. For increasing visibility in dark subway stations.

3. Light transmitting concrete is able to be used in an architectural construction sector for road and buildings.

4. This concrete can be used for ceilings of large administrative center building which reduce the lighting costs during daylight hours.

OBJECTIVES

1. To compare compressive strength of normal concrete with fibre reinforced concrete.

2. To check the variation of compressive strength of fibre reinforced concrete with the different diameter of fibres.

3. To compare the light transmitting properties of normal concrete with that of fibre reinforced concrete.

4. To check the variations of light transmitting properties of fibre reinforced concrete with different diameter of fibres**.**

Material Requirement

The various materials used for this project work are as under:

Optical Fibre

A thin flexible and transparent wire prepared for light propagation is called optical fibre. The optical fibre has been constructed for the following reasons:

- The light wave cannot traverse long distance in air without any losses. To make loss less light wave communication, the optical waves can be guided through optical fibre.
- The optical fibre can be used for the many of industrial application and medical applications as well. The optical fibre consists of two media kept one inside the other. The centre transparent medium of optical fibre is called “core” and the outer is cladding. The refractive index of core will be always higher than the refractive index of cladding.

Cement

The cement used in this work is HK 53 grade Ordinary Portland cement. The cement was tested according to IS 12269: 1987 specifications.

Coarse Aggregates used in the project*:*

Graded crushed aggregate upto 10mm from river sindh in Ganderbal.

Fine Aggregates*:*

The Sand was used as this is locally available material. It was graded sand zone II according to Indian standard.

Water

Ordinary tap water with ph value 6.4 was used in this work for all concrete mixes and curing of specimens.

Admixture

BASF admixture was used as 2% by weight of cement. BASF was used in order to enhance self-compaction of concrete.

METHODOLOGY

PREPARATION OF MOULDS

This included the installation of optical fibre in the moulds and also the oiling was done on the inner faces of the moulds so as to avoid the breaking of the specimen during de-moulding.

COLLECTION OF MATERIALS

The material used in the project is cement, sand, coarse aggregates. The cement, sand and coarse aggregates are easily available in the market.

Proportioning

The proportions of the materials, including water, in concrete mixes used for determining the suitability of the materials available, shall be similar in all respects to those to be employed in the work. Where the proportions of the ingredients of the concrete as used on the site are to be specified by volume, they shall be calculated from the proportions by weight used in the test cubes and the unit weights of the materials.

Weighing

Batching is the process of measuring quantities of concrete mixture ingredients by either mass or volume and introducing them into the mixer. Most specifications require that batching be done by mass rather than by volume. Water and liquid admixtures can be measured either by volume or mass. Weigh batching is the correct method of measuring the materials. For important concrete, invariably weigh batching should be adopted. Use of weight system in batching, facilitates accuracy, flexibility and simplicity.

Mixing Concrete

There are two methods adopting for mixing concrete one is hand mixing and other is machine mixing. The method adopted for this project was machine mixing.

Mixing

Fine and coarse aggregate combinations were mixed for in a mixer. Cement,water and admixture were added to the aggregate mixe and whole combination was remixed. The total mixing time was five

minutes.The top surface of the specimens was trimmed to remove excess material and achieve smooth finish. The specimens were de-moulded after 24 h and cured in water till testing.

Casting of specimen

After mixing, the casting was done. The top surface of the specimens was trimmed to remove excess material and achieve smooth finish.

De-Moulding of specimens.

The specimens were de-moulded after 24 h .Before the filling of concrete the moulds were properly oiled from inside so as to avoid the breaking of specimens during de-moulding. The specimens were de-moulded after 24 hours of casting. The moulds screws were loosened with suitable means.

Curing

After de-moulding the cubes were kept for curing in a water tank of certain depth. The cubes were kept for curing till testing. The testing was done after 14,28 and 56 days.

EXPERIMENTAL PROCESS

TESTS

After curing the cubes were taken for testing.Following tests were carried out:

Compression Test: This test was done with the help of UTM. Loads at the time of the failure of each sample were noted and then the compressive strength was calculated as;

$$\text{Compressive strength (N/mm}^2) = \frac{\textbf{Maximum load \{in Newton\}}}{\textbf{Area \{in mm}^2\}}$$

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Figure : Concrete cube before and after compression strength test

Light transmission test

Lux meter was used for this test. A lux meter is a device which measures the intensity of light falling on its sensor. This reading is different from te measurements of actual light energy produced by the light source. It works by using a photo cell to capture light, which is then converted to an electric current and finally it gives the lux value. It is used in photography, video filming, measuring the brightness of the room.

Procedure

A certain number of cubes were casted after the installation of optical fibre of 0.5mm and 1mm diameter. Then the light from the source was allowed to pass through optical fibre falling on the sensor of lux meter to get the accurate result of transmissibility.

Table: Transmissibility test setup

S.No	Specimen	Dimensions
1	Cubes	6x6,7x7,8x8
2	Optical Fibre	0.5mm and 1mm

Fig: light transmitting from optical fibres

RESULTS

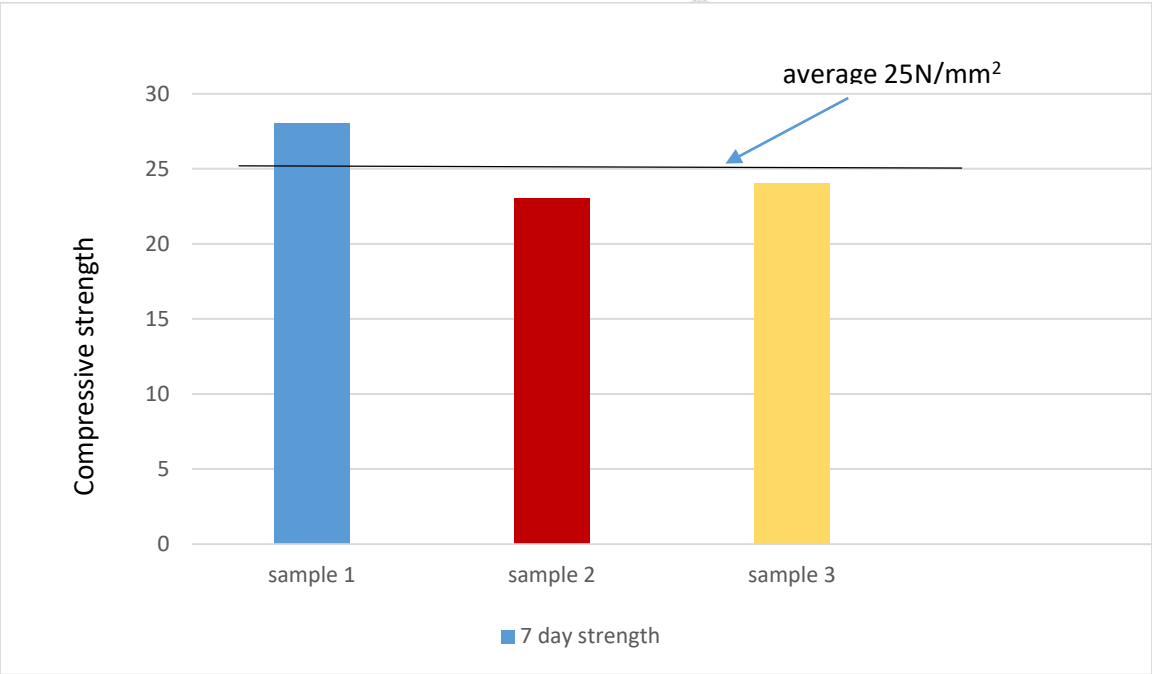
COMPRESSIVE STRENGTH TEST

The compressive strength results at 7 days and 28 days are shown in the table:

S.no	Curing period(in days)	Compressive Strength(N/mm^2)	Average compressive strength(N/mm^2)
1		28	
2	7	23	25
3		24	
4		42	

5	28	39	40
6		39	

Table: Compressive strength result for conventional concrete



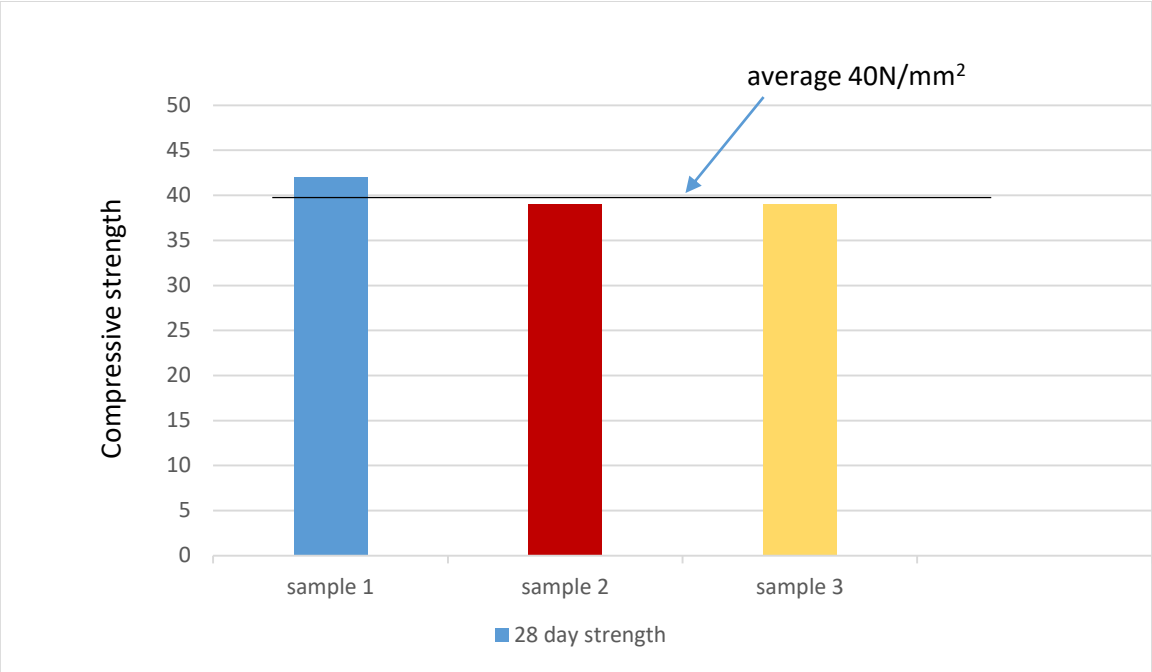
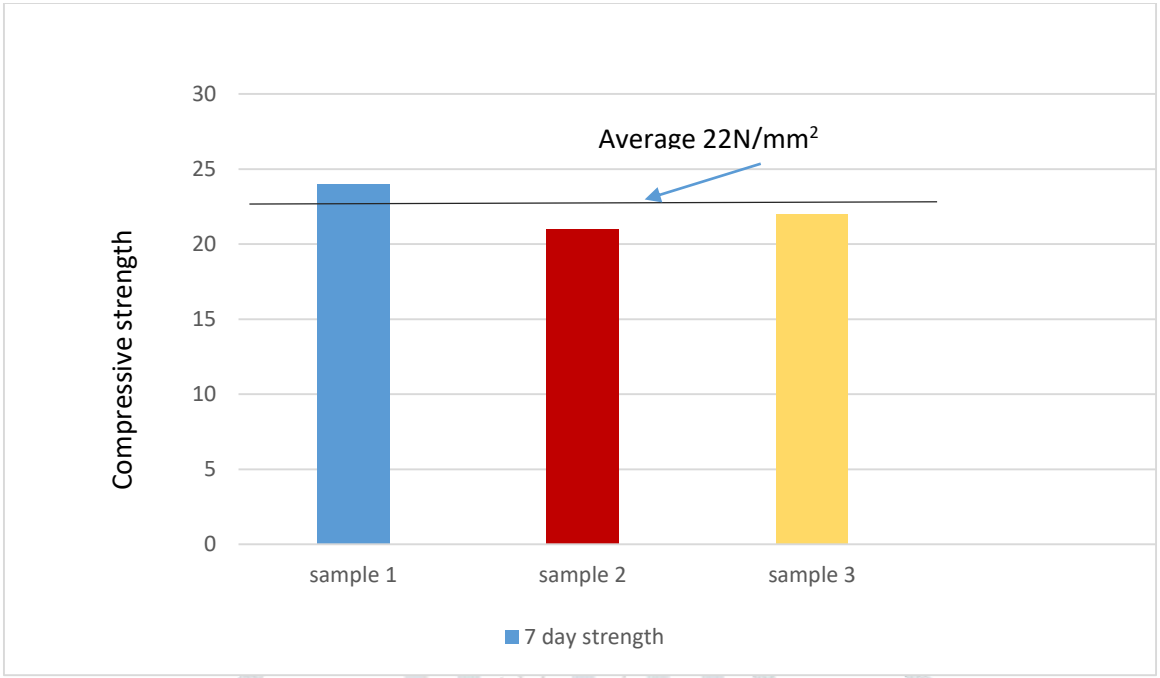


Figure: Compressive strength for conventional concrete at 7 days and 28 days

S.No.	Curing period (in days)	Compressive strength(mpa)	Avg. compressive strength(mpa)
1		24	
2	7	21	22
3		22	
4		38	
5	28	35	36
6		36	

Table: Compressive strength results for translucent concrete



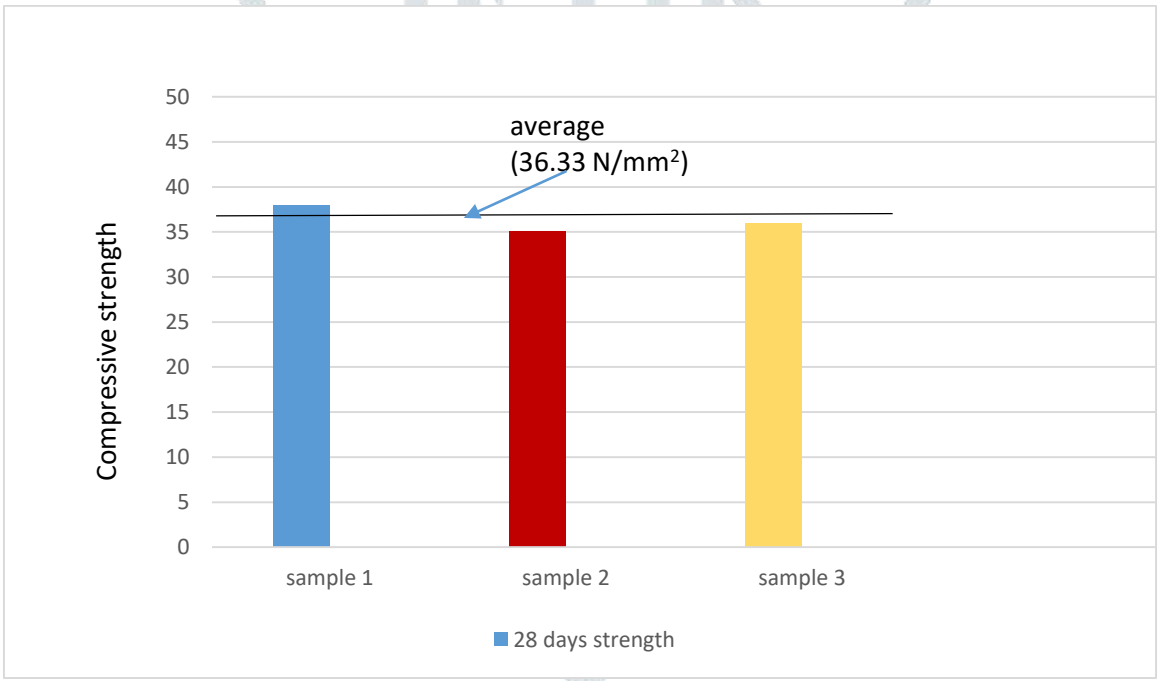


Figure: Compressive strength for translucent concrete at 7 and 28 days

LIGHT TRANSMISSION TEST

Transmissibility of optical fibre reinforced concrete was determined. The specimen was kept at a certain distance from the source and the light was allowed to pass through the optical fibres falling on the sensor of the lux meter. The transmissibility of source (bulb) in air at a certain distance was found to be 5030 lux.

The percentage of transmissibility was calculated by the formula

%age transmissibility = transmissibility through concrete/transmissibility through air

Table No. Transmissibility test result S.no	Transmissibility(in lux)	% transmissibility	Avg. transmissibility(in %)
1	191	3.8	
2	216	4.3	4.06
3	306	4.1	

Table: Transmissibility test result

The average transmissibility for the casted translucent concrete was found to be 4%.

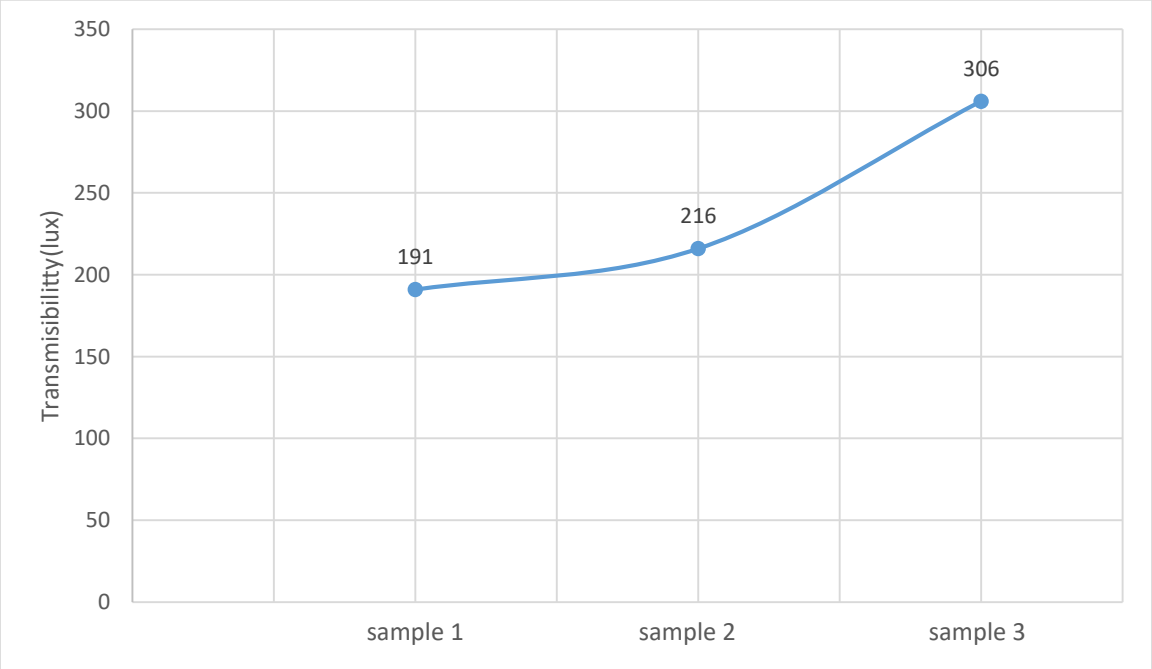


Figure: Transmissibility of samples

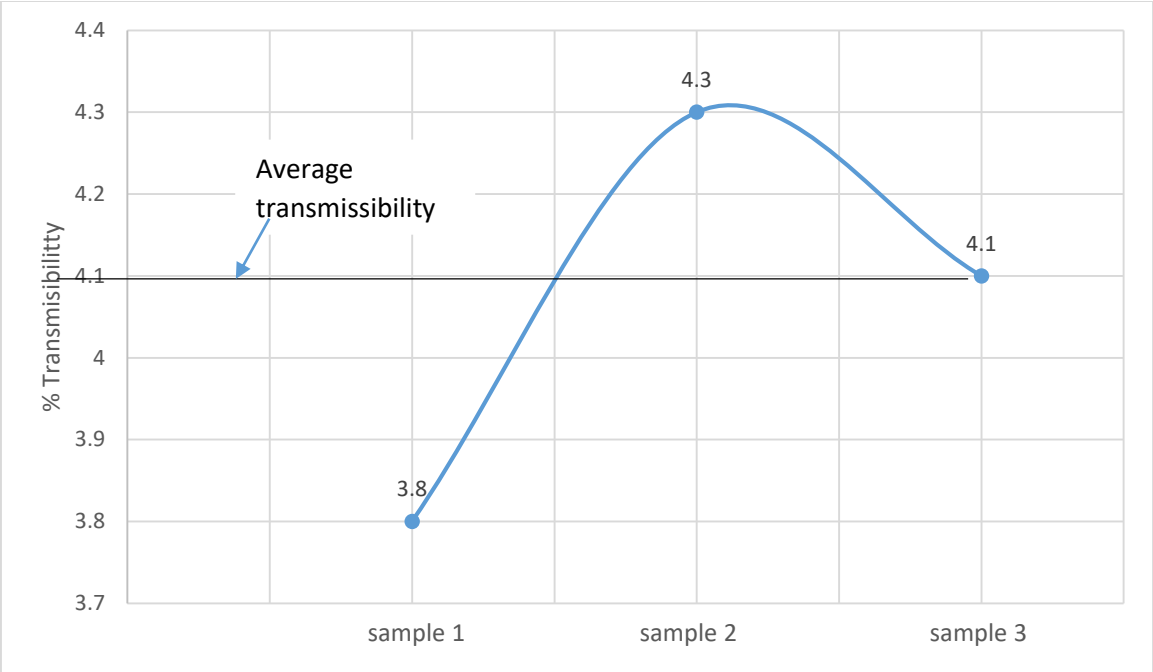


Figure: Percentage transmissibility of samples

CONCLUSION

- With the advancement of technology, our infrastructures should be modified.
- For a better development in the construction field, we need to introduce the use of renewable energy sources to meet the growing demand for energy.
- Translucent Concrete is the best solution for the above said problem.
- The translucent concrete used in the outside walls of a building can easily guide the light from the source to the interior of the building.
- The compressive strength of transparent concrete is quite considerable when compared to the conventional concrete.
- Translucent concrete can be also used for aesthetic purposes and is environment friendly.
- Translucent concrete can be most commonly used in the areas where the sunlight cannot reach with the desired intensity.

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