

**ABSTRACT**

Transparent concrete is the new type of concrete introduced in today's world which carries special property of light transmitting due to presence of light Optical fibres. Which is also known as translucent concrete or light transmitting concrete, it is achieved by replacing coarse aggregates with transparent alternate materials (Optical fibres). The binding material in transparent concrete may be able to transmit light by using clear resins the concrete mix. The concrete used in industry in present time is the general concrete which consists the fundamental materials i.e, water, cement, aggregate (which is coarse or fine) containing physical properties as- Grey in colour, no transparency, high density which blocks the possibility of distinguishing bodies, shapes through it. where as transparent concrete due to the presence of Optical fibre allows to identify bodies, shapes through it. The main purpose of using transparent concrete is to utilize sunlight as a light source following to result in saving or reducing power consumption for the same purpose, it can also be used for architectural purpose for new designs and attractive partition Wall. The Paper confines with the need of transparent concrete at present to utilize the sunlight and for architecture technologies. The new type of concrete can satisfy the green energy saving with its own Natural properties.

**KEYWORDS:** Transparent concrete, light transmitting, optical fiber, binding material, utilize sunlight, save power

**INTRODUCTION**

Transparent concrete was first mentioned in 1935 patent by Bernard Long as "LIGHT TRANSMITTING CONCRETE STRUCTURE" latterly the inventions and development in this field increased drastically. Transparent concrete can be manufactured by mixing 4-5% of optical fibers in the concrete. Transparent concrete in architecture is used as a façade material and for new designs to make the construction look much attractive. In today's time, where whole of the research is concentrated towards utilization of natural resource as much as possible and to reduce the consumption of resource which are decreasing with time, similarly in the field of construction 'GREEN BUILDING' is a good example of this which reduce the cost of construction and utilizes the waste fly-ash. In the same way transparent concrete is also an result of these type of research, which utilize the sunlight to emit light in the internal part of it and for the fine architecture as front. Building an environment which depends on the natural resource which is not expected to be finish in the life-cycle will be a great change towards the atmosphere for the upcoming generation, and transparent concrete is all about it. Our paper on use of transparent concrete aims to utilize the high amount of potential energy which exist in the form of sunlight, to emit light and to make people much aware about the benefits of using it in the construction. There were so many new techniques similar to it is introduced (mixing of Glass,2010), where transparent concrete mainly focus on Green Technology. While looking towards a material which can give the same strength as of general concrete with different texture we should go towards transparent concrete.

**OBJECTIVE**

to prepare sample model of transparent concrete to make people aware about its benefits towards surrounding and to architecture

## MATERIALS REQUIRED FOR TRANSPARENT CONCRETE

as above mentioned that transparent concrete is the type of concrete which has its specific quality of allowing light to pass through it hence it has many materials in common with the traditional concrete, except optical fiber in place of aggregate. We can also say that transparent concrete is manufactured by combination of two basic materials: fine concrete (without aggregate), optical fibers. and due to presence of these optical fibers, transparent concrete gets the ability to transmit light from natural or artificial source. Getting into the chemical composition, transparent concrete is the mixture of epoxy matrices and POLYCARBONATE WITH optical fiber, colloidal SILICA, DETA and Portland cement. which gives much more strength as from the standard/traditional concrete.

(note: - transparent concrete is manufactured using fine materials only i.e. it does not contain any coarse aggregate or coarse material)

**Cement:** - There is no special cement required for this as light is transmitted by the help of optical fiber. However cement works as a binder in transparent concrete too. Cement is a material which dries and sets and becomes hard and also reacts with CO<sub>2</sub> and binds the rest of materials to each other. Portland cement is the common type of cement widely used, grade of concrete is as per IS 4031-1988. The cement used in the research is ordinary Portland cement with specific gravity 3.15, with initial and final setting time as 48 minutes and 540 minutes.

**Water:** - Water free from impurities is specifically required for transparent concrete. In brief water should be free from oils, acids and other organic impurities and it shouldn't be soft water as it forms the weak concrete.

**Sand:** - There is no such specific requirement for sand. Only that it should be free from impurities.

**Optical fiber:** - optical fiber is the hair like thin fiber of glass or plastic cylindrical in shape that can transmit light through it. It functions on the principle of total internal reflection, it allows light wave to pass through it without consuming energy from it. Its shape is identical as cylindrical, the internal part of this is made of glass or plastic which is highly refractive i.e. the core of the optical fiber is of high refractive index, which results in the passage of light through it without much loss in the potential energy of light. The outer part of this cylindrical core is known to be cladding and has low refraction. Either then this optical fiber has one more quality which makes it different from others and much useful than any other material, it allows the light to pass through it even at an angle more than 60°. The commonly available diameters of optical fibers are .25 mm, .5 mm, .75 mm, 1 mm etc.

## PRINCIPLE

Transparent concrete is based on the principle of total internal reflection. When a light ray travels from a denser medium to a rarer medium such that the angle of incidence is greater than critical angle, the ray later reflects back to the same medium, and in optical fiber this total internal reflection repeats numerous times till it comes out from the other end of fiber. Minor loss of energy can be observed.

## MANUFACTURING PROCESS

For the manufacturing of transparent concrete there is no such specific and complicated procedure; it is almost the same as of the traditional concrete. The only difference is the presence of optical fiber in the aggregate and cement mix. Fibers are placed in layered form in the mould/cover (These moulds are made of wood or steel). Small layers of concrete are first filled and applied with the fibers and are alternatively applied to each other, and finished up with the concrete layer on top. Huge amount of optical fiber is used while doing this, to have maximum exposure to the light, and to maintain its strength. A general transparent concrete can be produced by adding 4% to 5% of optical fiber to the total volume of concrete mixture. This concrete mixture is made of fine materials only, as we are not using coarse aggregate. Various sizes of fiber are already mentioned (.25 mm to 2 mm) to have a good transmission of light through it. At the time of filling of concrete with fiber, concrete is poured slowly and carefully so that the position of optical fiber is not disturbed or displaced from its desired place, vibrating tables are used at the time of pouring of concrete to avoid the presence of void at the time of casting. While manufacturing transparent concrete one must follow Indian standard method (IS 10262-2009) for concrete mix ratio and proportion of mixture. Formwork can be removed after 24 hours of casting with proper curing of 2 times a day for consecutive 7 days, to have desired strength of concrete. After that, polishing and cutting work is done according to the need, for good shine and shape.

## ADVANTAGES / DISADVANTAGES

### Advantages

- The first and the most noticeable advantage of transparent concrete is that it can transmit light or can say it allows light to pass through it whereas the function of concrete is different.

- It is a part of “GREEN BUILDING”.
- As it transmit light from one side to other, natural or artificial, allows building to Have its own light source.
- It reduce consumption of energy.
- It is economic, and saves huge amount of money to be expended over electricity.
- A good technique, keeping in mind need of future needs.
- Transparent concrete uses sunlight as light source, i.e. utilization of natural resource is there.
- Can be used in cold countries as fine architecture façade, to transmit heat with sunlight to the inner end.
- It gives the visibility of texture of large scale object.
- Transparent concrete wall at homes can give the benefit of using less lights in the day time.
- Good appearance of transparent concrete gives an additional benefit as architectural point of view for good aesthetical view of building.
- 100% environment friendly.
- Can be used at the place where light is not able to come properly.

#### Disadvantages

- Especially skilled person is required for the casting work of transparent concrete.

#### CONCLUSION

Transparent concrete is a new innovation in concrete. It is no longer the same old, heavy, grey material with zero transparency. It is now innovated and reformed as a good looking, lively and beautiful concrete with more resistance, lighter in weight, weight or colored, etc. Transparent concrete can be produced by adding optical fiber in the fine concrete mixture. It has good light transmitting property, which is directly depended on the ratio of presence of optical fiber to the total volume of concrete. It is nowhere weak when compare to the traditional concrete on the bases of its strength, it carries equal strength of that of general traditional concrete. Either it has one more additional advantage over traditional concrete, its texture, aesthetical architecture point. It can be used as an awesome architecture work, with attractive looks. Can also be used in the area where natural sunlight cannot reach in the desired intensity. This new type of concreting represent the concept of “GREEN BUILDING” with self-sensing property of it.

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