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Translucent Concrete asa Construction Material

SHAHFAISALSALEH

Abstract: Traditional concrete is made up of cement, water, and aggregates (fine or coarse). There are occasions when specific ingredients are used in the production of our final products. In contrast to modern concrete, traditional concrete is grayish and dense, preventing light from passing through it. Transparent concrete will allow for better interaction between the structure and its surroundings, resulting in better and more natural lighting inside the structure. Optical fibers and POF (Plastic Optical Fibers) can simply be integrated with concrete to maintain a constant light transmission ratio concrete. Additionally, the cost of activities such as mixing, laying, and maintaining the concrete can be reduced. In addition to its translucent qualities, this form of concrete can also be used as a load-bearing structure because of its reinforcement mechanism. Incorporating the notion of green-buildings into this modern and novel sort of building material reduces the energy demand and self-sustainability features, which makes this attractive technology for civil engineering and infrastructure works.

Keywords:The facade of a green building Aesthetics, Fibre optics Nano-Optics, Prefabricated mold, scattered, crucial angle The blocks of concrete, Vibrating-table, Light transmission properties, Exterior wall coverings Decorative light bulbs

1.**INTRODUCTION**

With all of its unique features, concrete is a versatile building material that can be customized to meet our specific demands. Any country's progress in terms of economic and financial development is critical in this century. Because of the growing population and the limited amount of available land, the only option is vertical expansion, which opens the door to the construction of skyscrapers, which can be seen as a symbol of a country's progress. A variety of issues may arise as a result of this development, including an increase in energy usage. To address this, we've started using the concept of Green Building, which is becoming increasingly popular in our country as well. Translucent concrete, which is primarily formed by inserting optical fibers in between 5 and 8 percent of a concrete mix, is one example of this. Architects utilize translucent concrete as a façade material and for newly developed elements and members to improve a building's visual appeal.

It operates on the premise of using sunshine to illuminate the interior of the structure, as well as to create visually appealing works from the front. Optical fibers can be incorporated into translucent concrete in a variety of ways, but the primary goal is to reduce energy consumption and increase the reliance on renewable and sustainable means of energy.

M.Tech(ConstructionTechnologyandManagement)studentatAl-FalahUniversity,Faridabad,Haryana
salehshahfaisal@gmail.com

2.**MATERIALSREQUIREDFORTRANSLUCENTCONCRETE**

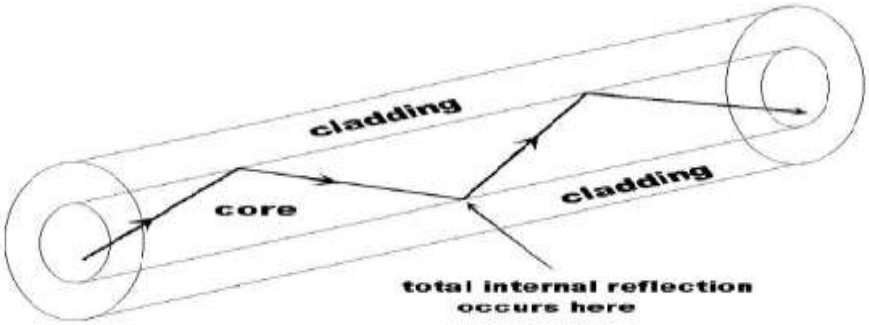
When compared to regular concrete, translucent concrete allows more light to pass through. As a result, it contains more components. Fine concrete (without coarse-aggregates) and optical fibers [2] are used to create translucent concrete. Optical fibers, colloidal silica gel, diethylenetriamin, and ordinary Portland Cement combine with epoxy and polycarbonate components in chemically translucent concrete to provide more compressive strength than standard concrete. When combined with the appropriate catalyst, they create a strong bond. In most cases, diethylenetriamine (DETA) is utilized as a setting additive, which is dehydrated on molecular sieves before to usage.

2.1 Cement: - The role of cement is to work as a binding material in transparent concrete as it does in ordinary concrete. Ordinary Portland Cement (OPC) is most commonly used.

2.2 Water:- Watermustbefreefromimpuritiesasperthecodalprovisionsspecifiedfortranslucentconcrete.Thus water should be free from chlorides, solid-wastes, suspended solids, colloidal particles, acids and other organic impurities.

2.3 Sand: - There exists no specific provision for selection of sand. Only criterion is that it should be free from impurities like mud, clay, dirt etc

2.4 Optical fiber: - Thin, cylindrical glass or plastic fibers are used to transmit light readily through the optical fiber.



Internal refraction allows sunlight to travel through it without wasting any energy. There is a large amount of glass or plastic in the optical fiber's core, which is extremely reflective. There's cladding material on the outside of the body, which has an extremely low refraction index. Light may travel through optical fibers even at an angle greater than 60*[4]. Optical fibers typically have a diameter of.2 mm to 1 mm.

Figure2.1Reflectionmechanismofanopticalfiber.

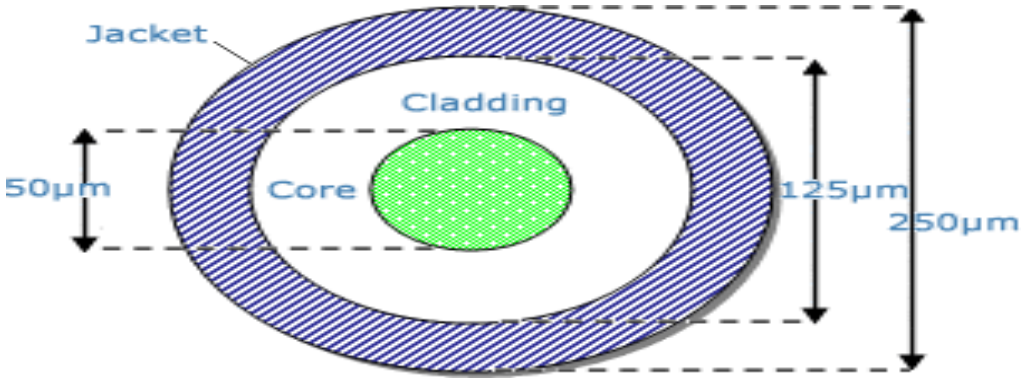


Figure2.1Transversesectionofanopticalfiber.

3. **PRINCIPLEOFWORKING**

The "Nano-Optics" approach is used to create translucent concrete [5]. Optical fibers transmit the same quantity of light regardless of how many slits are positioned next to each other or how they are arranged. So light can be carried over and through the material using optical fibers embedded in the concrete. Basically, transparent concrete relies solely on the reflection of its own internal light. If the angle of incidence is greater than the critical angle, the ray reflects back to the same medium and in optical fiber this entire internal refraction repeats several times until it exits from the opposite end

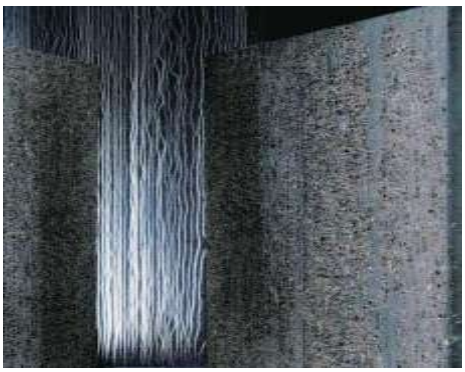


Figure3.2Readilyavailablefiberbu ıdle

4. MANUFACTURINGPROCESS

Unlike ordinary concrete, the process for making translucent concrete is remarkably similar to that of traditional concrete [7]. Concealed fibers in the sand and cement make translucent concrete unique. The prefabricated mold/cover (which is often made of wood or steel) is lined with layers of fibers [8]. First, thin layers of concrete are filled and then, in alternating layers, fibers are added. Finally, a relatively thick coating

of concrete is applied on top. In order to get the most light and keep its strength, optical fibers are

utilized in large quantities. For the most part, transparent concrete can be made by adding between 4% and 8% of optical fibers to the entire volume of concrete. Only fine ingredients and no coarse aggregate are utilized in the concrete mix. To meet the criterion of light transmission, optical fibers have a thickness between.002mm and 2mm [9]. In order to keep the optical fibers in place throughout the concreting process, concrete is poured slowly and carefully. In order to eliminate or reduce casting voids, a vibrating table is employed during the concrete pouring process After 24 hours of casting, the formwork can be removed. [10] It is necessary to follow a 7-day curing regimen that includes two curing sessions per day in order to attain the requisite concrete strength. Cutting machines or hand tools are used to remove fibers from the surface of concrete blocks [11]. Because the surface left after cutting the fiber's edges is somewhat rough, adequate

finishing is required to make it smooth. Between the two faces of the concrete blocks, light beams are guided by optical cables. When the light reflected from the bright side of the wall is parallel to the darker side, the light appears to be unchanged. The bright and clear shadows on the other side of the wall are arguably the most important type of this phenomenon. Light can travel through the concrete more easily if the layer thickness is reduced [12].

Figure4.1Formworkormouldusedforlayingtranslucentconcretewithfibersalreadybeingplaced.

5. **ADVANTAGES**

Texture can be easily seen in large-scale transparent concrete products, but the finer translucent concrete becomes hazy from a distance.

We can use less electricity at home during daylight hours when a solid wall is equipped to transfer light [13]. It also has good architectural features and an attractive appearance.

In places where light cannot reach, transparent concrete is employed.

Transparent concrete can be used in construction to save energy.

Because of its light-transmitting properties, energy usage can be minimized, making it environmentally beneficial.

It's a good idea to think about future generations when using this method.

The light source for translucent concrete is sunlight, i.e. the use of a renewable natural energy source.

Using correct melting and screening methods, it is possible to recover the binding material and aggregates.

As compared to typical concrete, it is much easier to repair damage using this material.

Concreting translucent concrete doesn't necessitate the use of complicated machinery.

Because of its strong resistance to UV radiation, translucent concrete is more user-friendly.

• Environmentally friendly to the nth degree

• It makes textures, especially on the macro level, easily visible.

DISADVANTAGES

There are a few things to keep in mind while working with translucent concrete: • It is more expensive than standard concrete because of the usage of optical fibers;

• The availability of optical fibers is also an issue; this could raise shipping costs.

APPLICATIONS

Ideal for laying floors, paving, designing interiors, and building load-bearing walls.

• Thin panels and blocks are used to construct facades, interior wall cladding, and dividing walls.

• Also used in furniture for a variety of reasons, including durability, aesthetics, and functionality.

Fixtures with optical fibers are available [16].

When used in dark subways and underground stations, it greatly enhances visibility.

In the event of a power outage or a natural disaster, it helps to illuminate inside fire exits.

Speed breakers and diversions on roadways are illuminated with translucent concrete, which is critical to traffic management and averting accidents, especially at night.

Figure7.1and7.2;Aestheticattractiveinteriorviewprovidedbyusingtranslucentconcretepanels.

6. CONCLUSION

Transparent concrete is a new advancement in concrete technology. ' It appears to be a light, gray, and opaque material. It's now possible to create aesthetically pleasing concrete that is stronger, tougher, lighter, and more colorful thanks to developments in the field of concrete technology. In order to create transparent concrete, optical fibers with a greater diameter are added to the mix along with the finer concrete. Optical fibers in the concrete mix play a key role in its light-transmitting properties. It's a great piece of architecture that has a lot of visual appeal. Useful in areas when sunlight is not strong enough to meet expectations. Self-sustaining and energy-conserving, this concrete symbolizes the "GREEN BUILDING" concept [18]. Decorative lamps, illuminating panels, and other home goods made of translucent concrete are all examples of everyday products that can be made using this material. Since it is more expensive, larger-scale use of translucent concrete isn't an option. However, advancements in construction technology and cost-cutting measures can alleviate this dilemma, allowing its widespread use. In the future, instead of traditional concrete, museums, historically significant sites, and specific exhibitions could employ translucent concrete, which can be considered an art form.

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