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Research Paper

TRANSPARENT CONCRETE AS A GREEN MATERIAL FOR BUILDING

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Concrete, that traditionally solid, substantial building material, is getting a makeover. Engineers have now developed concrete mixtures that are capable of transmitting light. By switching the ingredients of traditional concrete with transparent ones, or embedding fiber optics, translucent concrete has become a reality. Light Transmitting concrete, also knows as translucent concrete. It is the brightest building material development in recent years. It is one of the newest, most functional and revolutionary element in green construction material. In this paper the manufacturing ,uses and future scope of transparent concrete is widely given. However, this innovative new material, while still partially in the development stages, is beginning to be used in a variety of applications in architecture, and promises vast opportunities in the future.

Keywords: Transparent concrete, Optical fibre, Concrete, Aggregate

INTRODUCTION

Concrete has been used since Roman times, but its basic components have remained the same. Three ingredients make up the dry mix: coarse aggregate, consisting of larger pieces of material like stones or gravel; fine aggregate, made up of smaller particles such as sand; and cement, a very fine powder material that binds the mix together when water is added. Engineers have come up with several potential types of mixtures for translucent concrete. One approach is to exchange the traditional ingredients with transparent or translucent alternatives. Aggregates can be replaced with transparent alternatives, and the bonding material itself may be able to transmit light by incorporating clear resins in the mix. Another approach is the “combination of optical fibers and fine concrete”.

MATERIAL USED FOR MANUFACTURING OF TRANSPARENT CONCRETE

It is a combination of fibre optics and fine concrete. It can be produced as prefabricated building blocks and panels. Due to the small size of the fibers, they blend into concrete becoming a component of the material like small pieces of aggregate.

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Thousands of optical fibers strands are placed in concrete to transmit light, either natural or artificial, into all spaces enclosed by the translucent concrete panels.

Figure 1: Optical Fibres

Material Performance

- Concrete embedded with optical glass fibers running in a matrix while still retaining the strength of concrete.
- High density top layer concrete
- Infused with optical fibers
- Frost and deicing salt resistant
- Fire protection classification A2
- Highest UV resistance

HOW TRANSPARENT CONCRETE MADE

1. Strands of optical fibers are cast by the thousands into concrete to transmit light, either natural or artificial, into all spaces surrounding the resulting translucent panels. Light-transmitting concrete is produced by adding 4% to 5% optical fibers (by volume) into the concrete mixture. The fibers run parallel to each other, transmitting light between two surfaces of the concrete element in which they are embedded. Thickness of the optical fibers can be varied between 2 µm and 2 mm to suit the particular requirements of light transmission.
2. Originally, the fiber filaments were placed individually in the concrete, making production time-consuming and costly. Newer, semi-automatic production processes use woven fiber fabric instead of single filaments. Fabric and concrete are alternately inserted into molds at intervals of approximately 2 mm to 5 mm. Smaller or thinner layers allow an increased amount of light to pass through the concrete. Following casting, the material is cut into panels or blocks of the specified thickness and the surface is then typically polished, resulting in finishes ranging from semi-gloss to high-gloss.
3. The concrete mixture is made from fine materials only: it contains no coarse aggregate. The compressive strength of greater than 70 MPa (over 10,000 psi) is comparable to that of high-strength concretes.

USED OF TRANSLUCENT CONCRETE

Translucent concrete is not currently widely produced. There are only a select few companies, and the process is somewhat low-tech and slow. It can only be produced as pre-cast or prefabricated blocks and panels; it cannot be poured on site like traditional concrete. With its light-transmitting properties, however, translucent concrete has the power to potentially transform the interior of concrete

buildings, making them appear fresh, open and spacious.

Figure 2: Example of Transparent Concrete

Traditional Uses

- Translucent blocks suitable for floors, pavements and load-bearing walls
- Facades, interior wall cladding and dividing walls based on thin panels.

Emerging Uses/Trends

- Partitions
- Furniture
- Light fixtures
- Light sidewalks at night
- Increasing visibility in dark subway stations
- Lighting indoor fire escapes in the event of a power failure
- Illuminating speed bumps on roadways at night
- Stairs
- Decorative Tiles
- Lamps

Blocks of LiTraCon can be produced in different sizes, giving builders a wide variety of options when working with the material. So far, the blocks have been used in many buildings, for everything from desks to interior and exterior walls to lamps, and even an outdoor memorial. The material transmits light up to 20 m, so the concrete can be very thick while still making use of its light transmitting capabilities. The possible uses for LiTraCon are nearly endless. The blocks may even be used in the construction of energy-smart homes to reduce electricity costs by allowing more daylight to penetrate the structure.

ENVIRONMENTAL IMPACT

When a solid wall is imbued with the ability to transmit light, it means that a home can use fewer lights in their house during daylight hours. Since the insulating capacity of the wall is unchanged, the result is a net energy gain.

A GLOWING FUTURE

Several years ago, the material was featured in the “Liquid Stone” exhibit at the National Building Museum, and started opening peoples’ eyes to all kinds of possibilities. While the material has distinct architectural and interior design appeal, some of the companies involved in light-transmitting concrete production envision using the distinct looks and unique abilities of this concrete for practical applications. Although translucent concrete has been used primarily as an interior decoration, its creators have “visions of cities that glow from within, and buildings whose windows need

not be flat, rectangular panes, but can be arbitrary regions of transparency within flowing, curving walls". It can at the same time be building material and light source, can separate and connect, can be wall or floor, ambient lighting or eye-catcher. Translucent concrete is also a great insulating material that protects against outdoor extreme temperatures while also letting in daylight. This makes it an excellent compromise for buildings in harsh climates, where it can shut out heat or cold without shutting the building off from daylight. It can be used to illuminate underground buildings and structures, such as subway stations. Translucent concrete could provide safety applications in the future such as speed bumps that could be lit "from below to make them more visible at night", or to light indoor fire escapes in case of a power failure. It even has the potential to be sustainable; the aggregate can be replaced with crushed recycled glass.

CONCLUSION

Translucent concrete is one of the most interesting new takes on the historically stiff and uninspiring building material. It could be used almost anywhere glass or traditional concrete are used. Translucent concrete combines the fluid potential of concrete with glass ability to admit light, and it also retains privacy and can be used as structural support. The possibilities for translucent concrete are innumerable; the more it is used, the more new uses will be discovered. As with any new material, it is expensive and still has some issues to be resolved .In the next few years, as engineers further explore this exciting new material, it is sure to be employed in a variety of interesting ways that will change the opacity of architecture as we know it.

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