Experimental Study on Translucent Mortar Brick Using Plastic Optical Fibre

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doi.org/10.64643/IJIRTV12I11-201251-459

***Abstract*—Translucent concrete bricks (often referred to as Translucent Cement Mortar - TCM or Translucent Concrete Blocks) represent an innovative, light-transmitting building material that combines high-grade concrete with optical fibres to allow natural light to pass through opaque structures. This sustainable material, often composed of 95% concrete and 5% optical fibres, is used for both structural and decorative applications, such as cladding and partition walls. Translucent bricks represent a significant innovation in sustainable architecture and civil engineering. Unlike traditional masonry that blocks light, these bricks integrate optical fibres within a concrete or matrix. We also use fly ash to strengthen the brick. The fly ash is a waste material it's widely available, low cost and also can replace the cement partially. This design allows for the transmission of natural or artificial light from one side to the other, creating a unique aesthetic effect where shadows and silhouettes are visible through the wall. By the use of these bricks, we can reduce the usage of the artificial lighting in day time. Unlike fully transparent glass, these bricks offer a, "hazy" or "shadowed" view of the outside, providing a secure, high-privacy, and decorative alternative to traditional walls.**

***Index Terms*—plastic optical fibre, ordinary Portland cement, fine aggregate (m- sand), fly ash, water.**

I. INTRODUCTION

The traditional bricks made from clay possesses higher strength by burning, it causes pollution to the nature atmosphere and also to the workers. And these types of bricks completely block the sun light and other artificial lightings. by developing the translucent mortar brick using the plastic optical fibre we can they avoid the burning process of the traditional brick. Because of using the plastic optical fibre, we can transmit light through the brick. It helps in reducing the artificial lighting in the day time. We can use the light from sun to provide interior lighting. These bricks possess higher strength than traditional clay bricks. So, we can use this as load bearing bricks as well as non - load bearing.

This study focuses on the partial replacement cement with fly ash to improve the properties of the brick. By using the fly ash, it does not only help in the waste management but also helps in increasing the properties of brick like compressive strength and workability. The major motive of our project is to construct a brick that can transmit light and use the waste material fly ash as partial replacement for the cement so we can reduce the use of the cement. By this project we analyse this method is applicable in real life.

II. LITRATURE REVIEW

Nowadays one of the main problems that affecting the daily life of the people is the higher use of the electricity on the light. By these bricks we can reduce the usage of the of the artificial light up to 30%. And also using the fly ash as the partial replacement for the cement can help in reducing the usage of the cement and helps in waste management. It does not require the process of burning so it improves the atmosphere with less pollution. Its posses' higher strength than traditional clay brick so we can use it as both load bearing and non-load bearing structures.

III. METHADOLAGY

The methodology for this experimental study involves the preparation and testing of translucent mortar brick

by partially replacing cement with cement. Initially, the required materials such as cement, fine aggregate, optical fibre, and water are collected. The multiwalled optical fibre is used as the main material in the manufacturing brick. The optical fibre is tested for its light transmittance ability. The dimension of the brick is 19cmx9cmx9cm. the optical fibre placed in the brick in horizontal. So, the optical fibre is cut in to small pieces of 9cm length wisely.

The customized mould is prepared for this brick. The optical fibre is provided in the mould in horizontal by applying both ends with tension so the optical fibre does not move from its place. We arranged the optical fibre in the spacing of 1cm, 1.5cm, 2cm leading into having 72, 103, 144 pieces of optical fibre for each brick.

The mixing process of the mortar is taken place as dry mixing the cement, fly ash and fine aggregate (m-sand) and using required amount of water for the mixing.

The prepared mortar is poured into the early prepared mould carefully without damaging the plastic optical fibre. We provide external tampering and vibrations for the tampering process, so the optical fibre does not get damage. So, we can get a uniform pattern.

IV. MATERIALS

The materials that are used in the preparation of brick are

a) Cement

OPC 53 Grade Cement is a high-strength variant of Ordinary Portland Cement, recognized primarily for attaining a minimum compressive strength of 53 MPa (or 530 kg/cm²) after 28 days of curing. It is widely used in projects requiring rapid strength development and high load bearing strength.

b) Fine aggregate

Manufactured Sand (M Sand) consists of high-quality angular and cubical particles produced by crushing hard granite stones. It serves as a sustainable, consistent substitute for natural river sand in construction, offering higher compressive strength and durability due to its superior mechanical interlocking.

c) Optical fibre

Plastic Optical Fiber (POF) is an optical fibre made of polymer (plastic) rather than traditional silica glass. It is designed to carry data using light pulses, similar to glass fibres, but is optimized for shorter distances and ease of use.

d) Fly ash

Fly ash is a fine, powdery byproduct of coal combustion, composed primarily of spherical, glassy particles (silica, alumina, iron, and calcium). It acts as a pozzolan, reacting with lime to create cementitious compounds, enhancing concrete strength and durability. Key properties include high fineness (0.5–1000

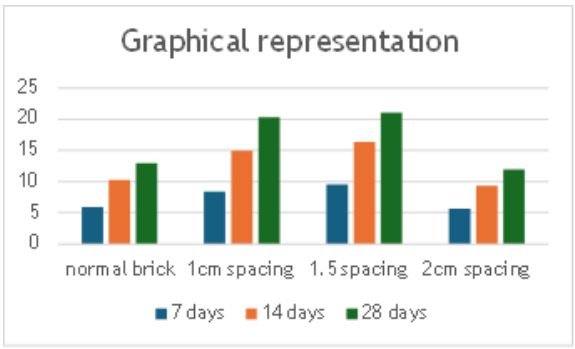
), low bulk density, and pozzolanic activity.

V. COMPRESSION TEST

The compressive strength test is conducted to determine the strength of concrete. It is one of the most important tests in brick. In this test, the brick is prepared in the dimensions 19cmx9cmx9cm according to the required mix. After casting, the bricks are kept in moulds for 24 hours and then removed and cured in water for 7, 14, or 28 days. Before testing, the bricks are taken out from the curing tank and wiped to remove excess water. The dimensions of the brick are checked to ensure accuracy.

Result of compression test

Number of holes	7 days	14 days	28 days
Normal	5.9	10.28	12.95
72	8.43	14.96	20.35
103	9.53	16.37	21.05
144	5.67	9.36	11.94



VI. CONCLUSION

From the experimental investigation on the partial replacement of cement with fly ash in mortar, and adding plastic optical fibre for transmitting light it is concluded that the strength of brick varies with the number of optical fibres in the brick. The test results indicate that compressive strength varies for each brick as the number of optical fibres increases the compressive strength decreases. When we provide the spacing of 1cm the strength increases gradually, also when we provide

1.5 spacing the number of optical fibres was 103 it shows even more strength than the normal and brick with 1cm spacing. When we provide the spacing of 2 cm the strength of the brick gradually decreases it shows even less strength than the normal brick. Therefore, the suitable amount of optical fibre for one brick is 72 and 103 with the spacing 1cm and 2cm. but the one which transmit more light through brick is the one having spacing of 2cm with 144 optical fibre. Therefore, it is not suitable for load bearing but we can use this for non-load bearing structures like high raised buildings.

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