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CELLULAR LIGHT WEIGHT CONCRETE BLOCKS WITH DIFFERENT MIX PROPORTIONS

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Abstract: The application of cellular lightweight concrete block in civil engineering suggest the best solution to the construction of building in the construction industry.CLC block makes the structure lightweight, strong, and thermally insulating. It gives the better solution to reduce the dead weight of the building. The idea about of density and ratio by which CLC may distinguish according to IS-2185(PART-4)2008. This study objective to explore the possibilitie: of using CLC block sustainable and cost-effective. By replacing cement in varying proportion this project aims to achieve to makes lightweight, durable, and Environment friendly.

Keywords: cement, stone dust, fly ash, water, foaming agent.

I. INTRODUCTION

CLC stands for Cellular Lightweight Concrete. It's a type of concrete that ha air bubble and foam mixed into it, making it lighter in weight compared to traditional concrete. CLC blocks are made by pouring this lightweight concrete into molds and allowing it to cure. These have various applications construction, such as for walls, partitions, and insulation. CLC blocks can helps keeps the temperature more stable and energy efficient. It also helpsin thermal insulation, reduce dead weight and ease of handling that enhance and add the value to construction project. Cellular Lightweight Concrete having benefit mainly Reduce weight, Low water absorption and Termite resistance etc. It is characterized as Low compressive strength and highly absorption of heat and sound

CLC is described as having a composition that can vary widely based on different proportions, typically consisting of natural aggregates such as coarse aggregate, fine aggregate, and cement. Unlike traditional concrete with a dry density greater than 2200 kg/m3, CLC has a much lower density, ranging from 800 to 2000 kg/m3, as per the standard IS-2185 (PART-4) 2008.

The advantages of CLC are enumerated, including its cost-effectiveness, reduced weight, termite resistance, low water absorption, and high absorption of heat and sound. However, CLC is noted for its relatively lower compressive strength compared to traditional concrete.

In terms of applications, CLC finds use in various civil engineering works, particularly in load and non-load-bearing walls, where CLC blocks serve as masonry units. The density of CLC discussed in the paper falls within the range of 800 kg/m3 to 1100 kg/m3, classified as GRADE B.

Overall, CLC offers a promising solution for lightweight construction, with its unique properties and advantages contributing to its increasing adoption in civil engineering projects.

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II. MATERIAL AND BLOCK DIMENSION

Cement:
A binder chemical substance for construction. Sets, hardens, and adheres to other materials to bind them together.
Often used to bind sand and gravel (aggregate). Cement mixed with fine aggregate produces mortar for masonry.
Cement mixed with sand and gravel produces concrete.

Water **:**
Potable water is use to manufacturing of clc blocks.

Fly ash :
Fly ash is the byproduct of thermal power plant. The grade of fly ash is class F and colour of fly ash is gray. The density of fly ash can vary from 540 to 860 kg/m3. Which is confirming to IS code – 3812 (part-1).

Foaming agen**t :**
The weight of the clc block becomes lighter due to the addition of foaming agent. It is insoluble in cold water and slightly soluble in hot water, easily dissolving in DIMETHY SALFOXIDE.The foaming agent is responsible for creating tiny bubble in the concrete mixture, which reduce it density and weight.

The dimension of the clc block are follows as –

LENGTH : 300 mm
BREADTH : 200 mm
HEIGHT : 100 mm

III. EXPERIMENTAL PROGRAM

The process of preparing Cellular Lightweight Concrete (CLC) involves several steps to ensure the appropriate proportioning of ingredients and the proper mixing of components to achieve the desired characteristics. Here's a summarized breakdown of the process:

1. **Proportioning of Water and Cement:** Initially, the appropriate amounts of water and cement are fed into a mixer and thoroughly mixed to ensure even distribution of the cement throughout the mixture.

2. **Addition of Fly Ash:** Fly ash, in different proportions, is then added to the mixer containing water and cement. Mixing continues to prepare the mortar slurry.

3. **Preparation of Pre-foamed:** Foam agent is diluted with water and extracted using a foam generator and air compressor to create pre-foamed solution.

4. **Mixing with Foam:** A measured amount of foam is added to the wet slurry to ensure complete mixing. The mixing process is completed to achieve a uniform consistency.

5. **Checking Wet Density:** The wet density of the cellular lightweight concrete is checked at appropriate ratios to ensure it meets desired specifications.

6. **Pouring into Moulds:** The wet slurry of cellular concrete is then pumped into assembled moulds. Standard cube moulds with dimensions of 300x200x100 mm are commonly used.

7. **Curing:** The moulds are left for a specified period, typically around 24 hours depending on local weather conditions. After this, the cubes are demoulded and cured for a further 21 to 28 days to achieve the desired strength and durability.

Overall, this process enables the production of CLC with free-flowing characteristics, allowing it to easily fill into corners and form solid structures with reduced weight. The careful proportioning and mixing ensure consistent quality and performance of the cellular lightweight concrete.

IV. Objective of CLC BLOCKS

- Excellent thermal insulation properties for enhanced energy efficiency, reducing heat transfer, improving comfort, and potential energy savings.
- Minimization of sound transmission through walls.
- Maintenance of reasonable compressive strength while achieving low density.
- Ideal material for cold storage rooms.
- Potential for higher insulation values depending on thickness and plaster.

V. LITRATURE REVIEW

1. Sagar Dhengare et al. (2015). Cellular Lightweight Concrete (CLWC) has ancient roots, using natural volcanic aggregates like pumice since antiquity. Lightweight concrete, incorporating expanding agents, enhances volume and reduces dead weight. Adoption of Cellular Lightweight Concrete (CLC) blocks offers a promising solution in construction, aligning with environmental conservation goals.

2. Mukul Rathore et al. (2015). Cellular Lightweight Concrete (CLC) gains popularity for its lower density and comparable strength to conventional bricks. Its composition involves air bubbles dispersed throughout the concrete mass, resulting in lighter weight. CLC offers a wide range of densities from 400 kg/m3 to 1,800 kg/m3. This report presents a comparative study between CLC and bricks, highlighting cost savings in structural design due to reduced dead load. It notes significant steel savings, with CLC blocks being 8.635kg lighter per beam member.

3. Nagesh. Mustapure et al.(2016). Cellular Lightweight Concrete (CLC) gains popularity for its lower density and comparable strength to conventional bricks. Its composition involves air bubbles dispersed throughout the concrete mass, resulting in lighter weight. CLC offers a wide range of densities from 400 kg/m3 to 1,800 kg/m3. This report presents a comparative study between CLC and bricks, highlighting cost savings in structural design due to reduced dead load. It notes significant steel savings, with CLC blocks being 8.635kg lighter per beam member. Keywords: Cellular lightweight concrete, CLC, brick masonry.

4. V. Murugesan et al. (2017). This paper investigates the strength of CLC blocks, manufactured using cement, fly ash, water, and foam agent ash. Similar to concrete, CLC gains strength over time. It boasts various advantages including pollution-free production, versatility in size and shape, lightweight properties, low water absorption, and a density of 800 kg/m3. Additionally, CLC blocks offer thermal conductivity, fire protection, reduced dead load, enhanced surface finish, eco-friendliness, faster construction, ease of handling, and suitability for cold storage applications. They also exhibit greater compressive strength, longer service life, and reduced plastering costs due to accurate sizing and shaping.

5. Enithkumar. A. N et al. (2023). Cellular Lightweight Concrete (CLC), also known as Foamed Concrete, offers numerous advantages and versatile applications, surpassing traditional concrete. It consists of Portland concrete, sand, and stable foam, resulting in lightweight concrete with densities ranging from 300kg/m3 to 1850kg/m3. The widespread adoption of CLC is due to its reduced density while maintaining quality comparable to regular blocks. This review extensively covers raw materials, manufacturing processes, characteristics, types, and applications of CLC, with a focus on geotechnical uses.

6. Vikash Bhatt et al. (2023). The utilization of cellular lightweight concrete (CLC) blocks in civil engineering offers an optimal solution for the building construction industry, particularly in reducing the dead weight of structures. This paper aims to study the characteristic strength of CLC based on various proportions of composite materials and recommends its use in construction. It also discusses the ratio and density parameters for characterizing CLC according to IS2185 (Part-4) 2008 standards.

VI. RESULTS

The compressive strength of CLC Blocks

- ✓ For ratio 1:3 of, minimum strength is 2.245 MPa at density 850 Kg/m3 and maximum strength is 4.855 MPa at 1020 Kg/mm3 density.
- ✓ For ratio 1:4 of, minimum strength is1.551 MPa at density 850 Kg/m3 and maximum strength is 2.951 MPa at 1020 Kg/mm3 density.
- ✓ For ratio 1:4:2 of, minimum strength is 1.821 MPa at density 850 Kg/m3 and maximum strength is 4.251 MPa at 1020 Kg/mm3 density.
- ✓ For ratio 1:5:2 of, minimum strength is 1.951 MPa at density 850 Kg/m3 and maximum strength is 2.968 MPa at 1020 Kg/mm3 density.

VII. Future scope

- CLC blocks are versatile, finding application in load-bearing walls and non-load bearing partitions.
- They offer ease in cutting and shaping, facilitating flexibility in both design and construction.
- Their cost-effectiveness further contributes to their appeal and widespread usage.

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