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# CELLULAR LIGHTWEIGHT CONCRETE

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## ABSTRACT

*Cellular Light weight Concrete (CLWC) is not a new invention in concrete world. It has been known since ancient times. It was made using natural aggregates of volcanic origin such as pumice, scoria, etc. The Greeks and the Romans used pumice in building construction. Lightweight concrete can be defined as a type of concrete which includes an expanding agent in that it increases the volume of the mixture while giving additional qualities such as inability and lessened the dead weight. The usage of Cellular Light-weight Concrete (CLC) blocks gives a prospective solution to building construction industry along with environmental preservation. In this paper, parametric experimental study for producing CLW C using fly ash is presented. The performance of cellular lightweight concrete in term of density and compressive strength are investigated. From the result, it can be seen that compressive strength for cellular light weight concrete is low for lower density mixture. The increments of void throughout the sample caused by the foam in the mixture lowers the density. As a result, compressive strength will also decrease with the increments in void. As strength increases its density also increases. The test result shows that the compressive strength of replacement mixture with 1% of foam is higher than of 1.4% foam. Compressive strength of mixture with 1.2% foam is slightly higher than that of 1.4% foam. In this experimental study, two grades of cement such as 53 and 43 grade cement are used. Compressive strength of 53 grade cement is slightly higher than 43 grade cement.*

***Keywords:- Cellular light weight concrete, CLWC, fly ash, volcanic, pumice, foam, Compressive strength.***

## I. INTRODUCTION

Concrete is most important construction materials. Concrete is a material used in building construction, consisting of a hard, chemically inert particulate substance, known as an aggregate that is bonded together by cement and water. In upcoming years there has been an increasing worldwide demand for the construction of buildings, roads and an airfield which has mitigate the raw material in concrete like aggregate. In some ruler areas, the huge quantities of aggregate that have already been used means that local materials are no longer available and the deficit has to be made up by importing materials from other place. Therefore a new direction towards Cellular Lightweight Concrete in building and civil engineering construction is used. The origin of the CLWC is difficult to assess, it would not be an exaggeration to say that its roots are from the ancient period. With the increase in the demand of CLWC and the unavailability of the aggregates, technology for producing lightweight aggregates has been developed. Lightweight concrete is the type of concrete which includes an expanding agent in that it increases the volume of the mixture and lessened the dead weight. It is lighter than the conventional concrete. It was first introduced by the Ro mans in the second century where ‘The Pantheon’ has been constructed using pumice. It is most common type of aggregate used in second century. CLWC can be achieved by omitting the finer sizes of the aggregate or replacing them by a light weight, cellular or porous aggregate. Particularly, lightweight concrete can be categorized into three groups:

a) No-fines concrete.
b) Lightweight aggregate concrete.
c) Aerated/Foamed concrete/cellular concrete/gas concrete.

## II. OBJECTIVE

To provide sufficient strength.

To provide low density ( for better insulation)

For low dying shrinkage.( to avoid cracking/rift)

## III. PHYSICAL PROPERTIES

1) Drying shrinkage:- Foam concrete possesses high drying shrinkage due to the absence of aggregates, i.e., up to 10 times greater than those observed on normal weight concrete. Autoclaving is reported to reduce the drying shrinkage significantly by 12–50% of that of moist-cured concrete due to a change in mineralogical compositions. The shrinkage of foam concrete reduces with density which is attributed to the lower paste content affecting the shrinkage in low density mixes.

2) Low Density and High Strength: Due to its low density, foam concrete imposes little vertical stress on the substructure - a particularly important attribute in areas sensitive to settlement. Heavier density (1000 kg/m$^{3+}$) foam concrete is mainly used for applications where water ingress would be an issue - infilling cellars, or in the construction of roof slabs for example.

3) Compressive strength: The compressive strength decreases exponentially with a reduction in density of foam concrete. The parameters affecting the strength of foam concrete are cement–sand and water–cement ratios, curing regime, type and particle size distribution of sand and type of foaming agent used. For dry density of foam concrete between 500 and 1000 kg/m3, the compressive strength decreases with an increase in void diameter. For densities higher than 1000 kg/m3, as the air-voids are far apart to have an influence on the compressive strength, the composition of the paste determines the compressive strength.

4) Flexural and tensile strengths:-Splitting tensile strengths of foam concrete are lower than those of equivalent normal weight and lightweight aggregate concrete with higher values observed for mixes with sand than those with fly ash .Use of Polypropylene fibres has been reported to enhance the performance with respect to tensile and flexural strength of foam concrete.

## IV. MATERIALS AND BLOCK DIMENSIONS

a. Cement

b. Water

c. Fly-Ash

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d. Foaming

Size of blocks is as following:-

Length: 600 mm.

Height: 250 mm.

Width: 200 mm.

## V. METHODOLOGY

At first begin with the water and fly ash. Blend for a couple of minutes and include concrete in stages and ensure the blending is careful (Mortar slurry planning).

- With the help of electric panel the desired quantity of water that is 165kgs of water is filled in the foam concrete mixer.
- The fly ash used for producing CLC blocks should not contain any aggregates & should be very fine as it can burst the bubbles formed in the slurry & hence it is passed through a sieve of 0.4 mm size.
- Then with the help of a conveyor belt the fly ash is passed to the foamed concrete mixer. The quantity of fly ash added is about 360kgs.
- The grade of cement preferred is M53 (OPC).
- The cement is added in the foam concrete mixer through the screw conveyor. The quantity of cement added is about 125kgs.
- Mould releasing oil like reebol (fosroc) need to be applied. By adding hardening chemical, we can reduce the de-mould time marginally. Also, it depends on the climatic conditions.
- Pumping of the CLC discharged from the plant to the mould can be done separately by foam concrete pump (screw pump). However density may affect up to 10% to 15%.
- In water curing procedure 12 to 14 days are required while in steam curing procedure 12 hours are required.
- The proportions of the various constituents vary depending up on the density to be achieved.

**Fig 1. Mould**

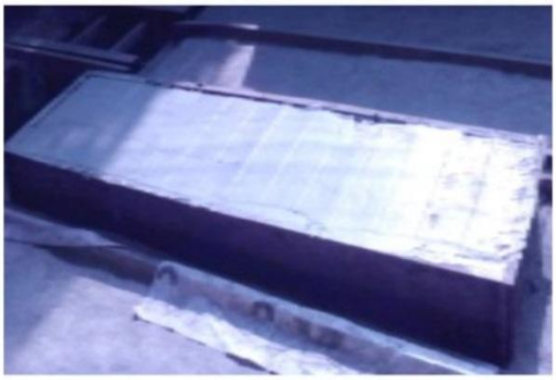

**Fig 2. Mould**

## VI. CLASSIFICATION OF CLC BLOCKS

Density of Fly Ash lightweight concrete range is 400kg/m$^3$ to 1800kg/m$^3$. Data gave in this paper is to thickness of 800kg/m$^3$ to 1000kg/m$^3$.

**Table 1. General Properties for water curing**

| SL. | PARAMETERS | CLC BLOCKS | | |
|---|---|---|---|---|
| 1 | DRY DENSITY (Kg/m3) | 800 | 900 | 1000 |
| 2 | COMPRESSIVE STRENGTH (N/mm2) | 2.6 | 3.2 | 3.8 |
| 3 | DRYING SHRINKAGE (mm/meter) | NO SHRINKAGE | NO SHRINKAGE | NO SHRINKAGE |
| 4 | THERMAL CONDUCTIVITY (W/m.k) | 0.32 | 0.34 | 0.36 |
| 5 | WATER ABSORPTION (%) | 11.87 | 11.51 | 11.37 |

**Table 2. General Properties for steam curing**

| SL. | PARAMETERS | CLC BLOCKS | | |
|---|---|---|---|---|
| 1 | DRY DENSITY (Kg/m3) | 800 | 900 | 1000 |
| 2 | COMPRESSIVE STRENGTH (N/mm2) | 2.7 | 3.3 | 4.1 |
| 3 | DRYING SHRINKAGE (mm/meter) | NO SHRINKAGE | NO SHRINKAGE | NO SHRINKAGE |
| 4 | THERMAL CONDUCTIVITY (W/m.k) | 0.32 | 0.34 | 0.36 |
| 5 | WATER ABSORPTION (%) | 11.68 | 11.47 | 11.26 |

**Fig 3. CLC Blocks**

**Advantages of Cellular Lightweight Concrete**

a) Cellular lightweight concrete does not settle, therefore no compaction.

b) It does not impose large loadings.

c) It is free flowing so spreads to fill all voids.

d) It has excellent load spreading characteristics.

**Applications of Cellular Lightweight Concrete**

a) Building Blocks : Blocks and panels can be made for partition and load bearing walls. They can be made with almost any dimensions.

b) Floor Screed: Foamed concrete can be used for floor screeds, creating a flat surface on uneven ground and raising floor levels.

c) Roof Insulation**:** Foamed Concrete is used extensively for roof insulation and for making a slope on flat roofs. It has good thermal insulation properties and because it is lightweight foamed concrete does not impose a large loading on the building.

d) Road Sub-Base**:** Foamed Concrete is being used road sub base on a bridge. Foamed concrete is lightweight so that the loading imposed on the bridge is minimized.

## VII. RESULT AND CONCLUSION

It can be concluded that the lightweight concrete has a desirable strength to be an alternative construction material for the industrialized building system. This study has shown that the use of fly ash in foamed concrete, either can greatly improve its properties. The properties of cellular lightweight concrete its advantages, disadvantages and applications were studied thoroughly.

Some of the features of foamed concrete blocks are as follows:-

 It requires low investment.

 It is a future product as burnt clay bricks are getting banned in India.

 The plant is easy to install.

 It can earn more profit as initial investment is less.

 Minimum 6000 sq. ft. area is required for setting theplant.

❖ It is a green product.

## REFERENCE

[1]. K.KrishnaBhavaniSiram (December 2012), International Journal of Engineering and Advanced Technology (IJEAT) ISSN: 2249 – 8958, Volume-2, Issue-2, Cellular Light- Weight Concrete Blocks as a Replacement of Burnt Clay Bricks

[2]. Xiaoheng Wang (2010), Environmental Pollution from rural brick-making Operations and their health effects on Workers.

[3]. IS 12269: 1987 – Specification for 53 grade ordinary Portland cement

[4]. IS 2185 (Part 4): 2008 – Concrete Masonry Units – Specification, Part 4- Preformed foam cellular concrete blocks.

[5]. P.S.Bhandari and Dr.K.M.Tajne, "Cellular Lightweight Concrete Using Fly Ash",International Journal of Innovative Research in Science, Engineering and Technology (An ISO 3297: 2007 Certified Organization) Vol. 3, Issue 11, November 2014.

[6]. HjhKamsiahMohd.Ismail, MohamadShazliFathi and NorpadzlihatunbteManaf,"Study of Lightweight Concrete Behaviour"

ISSN (O) 2454-9665
ISSN (P) 2454-0663

[7]. Satyendra Kumar Meena, Pushpendra Kumar Meena, Rakesh Kumar Meena, Rupayan Roy and Pawan Kumar Meena,''Cellular Lightweight Concrete''

[8]. K.KrishnaBhavaniSiram ,''Cellular Light-Weight Concrete Blocks as a Replacement of Burnt Clay Bricks'', International Journal of Engineering and Advanced Technology (IJEAT) ISSN: 2249 – 8958, Volume-2, Issue-2, December 2012