International Journal of Technical Innovation in Modern Engineering & Science (IJTIMES)
Impact Factor: 5.22 (SJIF-2017), e-ISSN: 2455-2585
Volume 5, Issue 09, September-2019

CELLULAR LIGHT-WEIGHT CONCRETE

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Abstract: ***The purpose of this project was to test the effectiveness of the Cellular light weight concrete (CLC) blocks .In the period of 21st century the major problem we are facing is the emission of greenhouse gas i.e., carbon dioxide from various sources to this context the emission of carbon dioxide in the bricks manufacture process have been recognized as a significant factor to global warming. The aim is now to solicit toward the greener environment. The use of cellular light-weight concrete (CLC) blocks gives an appropriate solution to building construction industry along with environmental preservation. In this paper cellular light weight concrete blocks are casted with different proportion to check its properties such as compressive strength, density, water absorption. Cellular light weight concrete gives better thermal insulation, sound insulation, durability, light weight and uniform size and shape.***

Keywords: CLC Technology, CLC Blocks, foam concrete, foaming agent.

Introduction:

Cellular concrete was first developed in Stockholm, Sweden in the early 19's. The technology rapidly spread into the different parts of the world, mostly in the Europe. Cellular concrete can be treated as aerated concrete where the foam bubbles are formed through open air mechanical stirring using concrete hand mixer after that a foaming agent is mixed into the water-cement slurry to make light weight Cement concrete. Foam concrete is a mixture of cement, fly ash, sand, water and foaming agent. When the foaming agent is mixed with water and air, later it is mixed into the cement slurry. The water-cement slurry gets setting around the foam bubbles so formed, this produced paste have sufficient strength to maintain its shape around the foam bubbles, it entrains 30-35% of air by volume into the concrete, as a result low density Cellular Concrete is obtained. Cellular Concrete can also float into the water surface, because of its light weight. It can be characterized as cellular material because it contains higher amount of pores further quality of Cellular concrete depend upon the quality and type of foaming agent used. No coarse aggregate is used in the production of the cellular concrete. The density of foam concrete generally varies from 800-1600kg/m3.The main advantage of Foam Concrete is it can be placed easily by pumping if necessary and does not require any compaction, vibration. Generally it could be called as highly workable concrete. It has excellent resistance against water and frost action. This report is prepared to show the activities and of the light weight concrete.

Material used and their specification:

1. Cement: - Cement is a binder, a substance used in construction that sets and hardens and can bind constituent materials used together. The most important types of cement are used as a component in the production of mortar in masonry, and of concrete, which is a combination of cement and an aggregate to form a strong building material. Here Ordinary Portland Cement (OPC) is preferred in the making of Foam concrete. The physical properties of OPC used in this project are:

Colour- White

Type- OPC grade 43

Compressive strength- 43MPa

Chemical composition of cement:

Compound	Chemical Composition
CaO	57.84
SiO2	20.33
Fe2o3	4.68
Al2O3	3.40
MgO	1.51
MnO	0.10
TiO2	0.09
K2O	0.72
Na2O	0.51
So2	7.26
Loss On Ignition	3.42
Insoluble Residue	1.23

2. **Fly ash: -** Fly Ashisspherical tiny glass beads .Materials such as Portland cement are solid angular particles. Fly Ash provide a greater workability of the powder portion to the concrete mixture which results in greater workability of the concrete and a lowering of water requirement for the same concrete consistency. The physical properties of fly ash used Type- Class C Fly ash

Density of fly ash- 1400kg/m3 Specific surface area-4000cm2/g
Colour- white

3. **Fine Sand:-** Fine aggregate are basically sands extracted from land or river (marine environment). Fine aggregates generally consist of natural sand or crushed stone. Particle size of fine sand is less than 2mm. The specific gravity of sand used in this experiment is 2.6. The density of sand used is 2600kg/m3 and having fineness modulus 2.63. Code provision used IS.383.1970.

4. Foaming agent:- foaming agent is a chemical which facilitates formation of foam such as surfactants and blowing agents. There are two types of foaming agent:

I. Synthetic-suitable for densities of 1000 kg/m3 and above.

II. Protein-suitable for densities from 400 to 1600 kg/m3

ÿ Protein-based foaming agents come from animal proteins (horn, blood, bones of cows, pigs & other remainders of animal carcasses). These surfactants might therefore be best suited to the production of foamed concrete of relatively high density &high strength.

ÿ Synthetic foaming agents are such chemicals which reduce the surface tension of liquid and commonly used globally to make blocks, bricks, CLC concrete etc,.. Where the high density is needed and it requires less energy for formation as compared to other foaming agents.

ÿ Physical properties of foaming agent which are used in making foam concrete or CLC are Type- Protein based foaming agent, Colour-White, State-liquid, Specific gravity-1.15, Ph at 20ºC-6.5 to 7.5, water solubility- infinite, Freezing point -3 to -5 °C. Recovers fully after freezing, Dosage- 1:25 (1 part foaming agent liquid mix into 25 part of water)

5. Concrete hand mixer:- In this project concrete hand mixer is best suitable for mixing cement slurry and it is also used in generating foam volume. Some specification of concrete hand mixer are having mixer power-350W (or 0.5hp), rotating speed- 14000rpm, power supply- 220-240V/50Hz.

6 **Mould:-** Standard size of mould (150mm*150mm*150mm) is used.

7 RESULTS AND DISCUSSION :-The mix proportion of CLC should be worked out such that it keeps the desired physical properties and compressive strength, sand to cement ratios are important as they are used to arrive at optimized concrete strength and water to cement ratio are carefully designed to obtain good workability as well as good binding property. Here CLC are to be designated as Mix-A, Mix-B and Mix-C according to their increasing densities.

Testing of fly ash:

1:- fineness test
2:- consistency test
3:- specific gravity test

Fineness test:-

Sample of fly ash W1 = 200 gm.
75 micron sieve is used after sieving 15 minutes
Wight retained on sieve W2 = 50 gm.
Weight passed through sieve W3 = 150 gm.
% passed through 75 micron sieve is 75 %.

Consistency test:

Weight of sample is taken 300 gm

Water is added 27 % of the weight of sample

Plunger penetrate the sample 7 mm from the bottom of vicat apparatus

So, consistency of the fly ash is obtained **27 %**

Specific gravity test: (using pycnometer)

w1 (empty container) =502 gm.

(dry soil) = 200 gm.

w2 (dry soil + empty container) = 702 gm.

w3 (water + dry soil + empty container) =1606 gm.

w4(Container + water) =1498 gm.

specific gravity (G)=(w2-w1)/((w2-w1)-(w3-w4))

specific gravity (G) is obtained 2.17
3 mix are prepared – (Cement: Fly ash: Sand)

Mix 1=1:1:0

Mix 2=1:1:0.5

Mix 3=1:1:1

Water cement ratio is taken as **0.75**

Foaming agent is diluted in ratio with water (1: 25).

Table 1.Mix 1

Specimen	Density	Compressive Strength	Water Absorption
Sample 1	801	8.9	12.58
Sample 2	790	7.1	12.48
Sample 3	793.5	8	12.45
Average	794.6	8	12.55

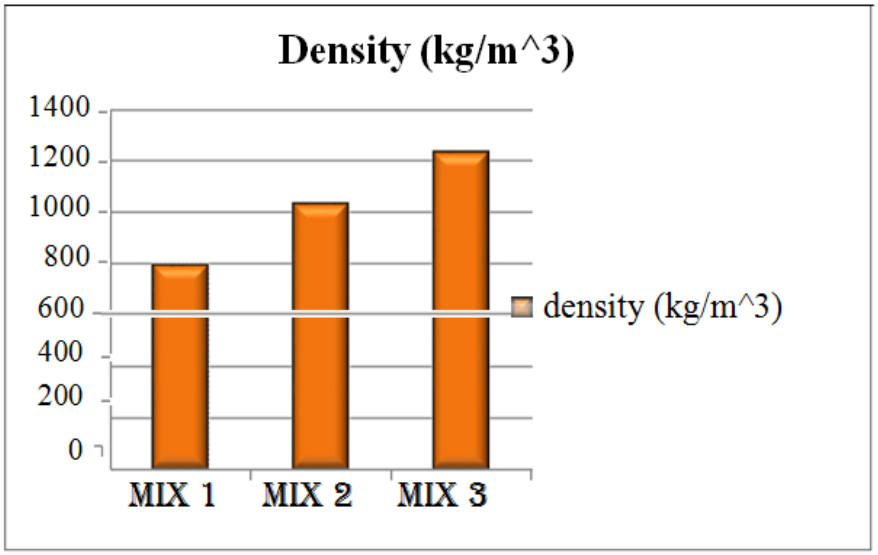
Table 2 Mix 2

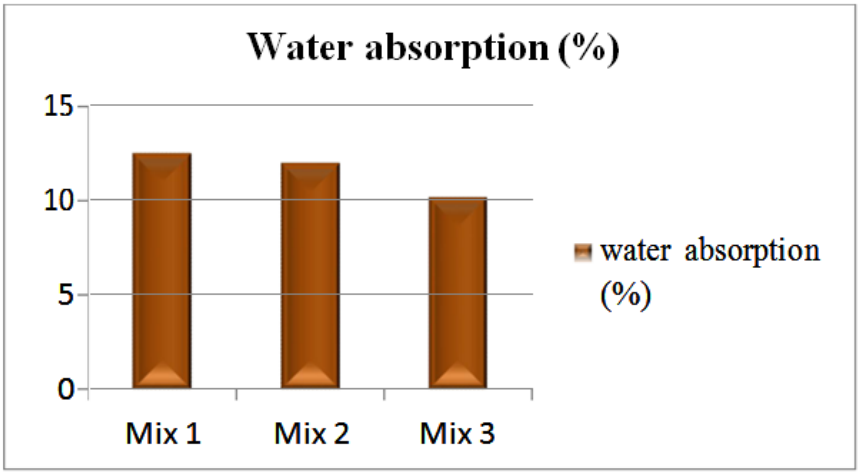
Specimen	Density	Compressive Strength	Water Absorption
Sample 1	1030	9.8	11.89
Sample 2	1038	10.4	12.15
Sample 3	1033.3	10.1	12.03
Average	1033.37	10.1	12.02

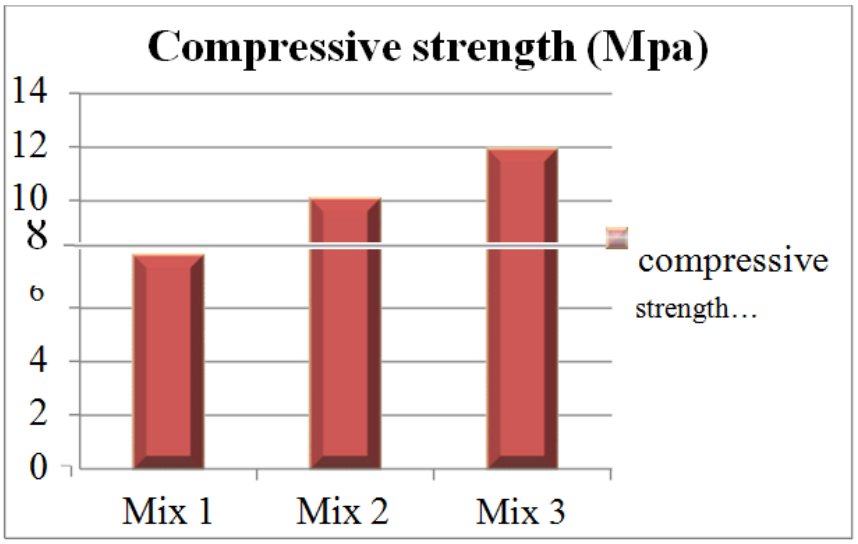
Table 3 Mix 3

Specimen	Density	Compressive strength	Water Absorption
Sample 1	1235	11.96	10.1
Sample 2	1237	12.06	9.9
Sample 3	1231	11.83	10.6
Average	*1234.33*	*11.95*	*10.2*

Comparison of Mixes with bar chart:-







CLC blocks after remoulding

preparation of foam

Conclusion:

Purpose of this project was to study the performance of CLC in terms of density, compressive strength and water absorption.

Conclusion of the project have been found that good compressive strength is found in CLC block if it is compared with clay bricks and by making some changes in proportion it can be also use as concrete structures its density is low and water absorption capacity is also low in compare to clay brick and concrete blocks also.

So CLC is useful for future construction and its scope is going to be vast due to its various properties which is written above.

CLC is eco-friendly with environment as well as economic in compare to concrete and clay brick.

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