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A Review on Light Weight Concrete Blocks using Aluminium Powder as a foaming agent

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Abstract: *Concrete technology is evolving, and many advancements and inventions have been produced to address various construction issues. Many lightweight concretes block manufacturing has been developed, with lightweight aggregates being one of them. In the construction business, brick is a common building material. Traditional clay bricks have been widely used in many sorts of construction for decades, particularly to produce building walls. The usage of clay bricks, on the other hand, has resulted in the ongoing mining of clay soil, which is not sustainable for the business. Concrete blocks arrived later in the sector, providing more options for the industry. Environmental and economic considerations are the two main issues with concrete blocks. If the weight of concrete blocks can be reduced, the requirement for them will be reduced.*

Keywords: **Light weight concrete blocks LWC, Foaming Agents Aluminium Powder.**

1. Introduction

Lightweight concrete is made with an expansion agent, which increases the volume of the mixture while simultaneously enhancing qualities such as nailability and lowers the dead weight. It has a lower density than conventional concrete. Lightweight concrete is commonly used in countries such as the United States, the United Kingdom, and Sweden. Lightweight concrete's key advantages are its low density and thermal conductivity. It has several advantages, including a smaller dead load, faster construction rates, and lower haulage and handling expenses. When lightweight concrete is applied to a wall, it retains its big spaces and does not develop laitance layers or cement films. The results of this study were based on the performance of aerated lightweight concrete blocks.

Due to its numerous advantages and applications over traditionally made concrete, lightweight concrete, also known as Foamed concrete, is one of the most widely utilized types of concrete in construction. Portland cement, sand, fly ash, water, and premade foam are mixed in various amounts to make foamed concrete. At construction sites, cellular lightweight concrete can be made with machines and mould designed for conventional concrete in ambiguous conditions.

2. Literature Survey

The study showed that is possible to achieve an optimized sound insulation between dwellings using a lightweight concrete single block, instead of using the Portuguese traditional ceramic brick double wall **[1]**. In this paper, an endeavor is made to think about on cellular lightweight solid squares, and suggest as it can be utilized as a part of building development **[2]**.

This study has shown that the use of fly ash in foamed concrete, either can greatly improve its properties. Most of the cleaner production effort is required in India and hence CLC blocks may be used as a replacement of burnt clay bricks, for construction purpose, which is advantageous in terms of general construction properties as well as eco – friendliness **[3]**. The usage of Cellular Light-weight Concrete (CLC) blocks gives a prospective solution to building construction industry along with environmental preservation **[4]**. Fly-ash is considered as one of the industrial waste products that cannot be easily disposed. It solves the problem of disposal of fly-ash and at the same time it reduces the cost of the construction. CLC is considered as environment friendly sustainable material produced with least energy demand **[5]**. Blocks give superior thermal & acoustic insulation because of low air infiltration. Moreover, lesser joints and better compacted (thin) joining mortar add to the thermal & acoustic insulation. This leads to well insulated interiors, keeping out warm air in summers and cold in winters. Blocks reduce energy cost by up to 30% **[6]**. Speedy construction due to its big size light weigh1.Concrete blocks, mostly those with hollow cores, offer different potential effects in masonry construction. They also give extraordinary compressive strength, and are most suitable to structures with light transverse loading when the cores stay blank **[7].** Ease of joining of blocks, plastering not required to cover the faces of blocks, less concrete and time is used in comparison of clay bricks due to its uniform surface.t and ease to cut in any size or shape **[8]**. FA being the most common pozzolanic material encountered in construction is a by-product of coal burning power plants. The FA is disposed of either by sluicing to ponds or hauling to solid waste disposal areas. **[9]** Disposal operations are quite expensive and require the use of land that could be used for other purposes obtained results it is determined that as the percentage of glass powder increases compressive strength increases but after 30% replacement of F.A. **[10].** Lightweight blocks are constructed with 30% replacement of F.A with glass powder and 20% replacement of C.A with EPS beads. This undertaking base on the execution of lightweight cement by utilizing quarry dust block. Anyway, adequate water bond proportion is indispensable to create sufficient union among concrete and water **[11]**. We use quarry dust as a substitution of fly fiery remains and furthermore utilized the materials concrete (OPC 53 grade), fly cinder, quarry dust, frothing operator. The compressive strength of foaming agent brick is higher than red brick **[12].** Light weight brick is economical than the fly ash and cement brick. The moisture content of the light weight brick is higher than conventional brick **[13].** The results show that the compressive strength, flexural strength and thermal conductivity increased with increased BA content due to tobermorite formation. However, approximately, 20% increase in both compressive (up to 11.61 MPa) and flexural strengths (up to 3.16 MPa) was found for mixes with 30% BA content in comparison to just around 6% increase in the thermal conductivity **[14]**. Sustainability and material use have been becoming increasingly important in industry and academia in recent years **[15].** The concrete specimens made with lightweight coarse aggregates and a dune sand were continuously cured in water for one or 7 days and then exposed to predominantly hot and humid seaside ambient conditions containing air-borne salts. After 7 days of initial curing and on subsequent exposure to hot and humid air both SLWCs attained an almost similar strength to those continuously water cured cubes at an age of 12 month **[16].**

3. Materials

a. Portland cement
b. Lime.
c. Foaming Agents (Aluminum powder)
d. Fly ash
e. Water
f. Gypsum
g. Casting molds and equipment.

4. Experimental Program

a. Compressive strength

The main physical quality of concrete (from which all others are derived) is compressive strength, which is the most commonly employed in design. It's one of the most important qualities for lightweight concrete quality management. The measured maximum resistance of a concrete specimen to axial loading is known as compressive strength. It is discovered by determining the maximum compression stress that a test cylinder or cube can withstand.

b. Water Absorption

Absorption capacity is a measure of the porosity of an aggregate; it is also used as a correlation factor in determination of free moisture by oven-drying method. The absorption capacity is determined by finding the weight of surface-dry sample after it has been soaked for 24 hr. and again finding the weight after the sample has been dried in an oven; the difference in weight, expressed as a percentage of the dry sample weight, is the absorption capacity. Absorption capacity can be determine using BS absorption test. The test is intended as a durability quality control check and the specified age is 28 days. The water absorption properties provide the best information about the durability of cementitious composite.

c. Bulk Density

Density can be either in fresh or hardened state. Fresh density is required for mix design and casting control purposes. According to researches of is that, a theoretical equation for finding fresh density may not be applicable. Many physical properties of foamed concrete depend upon its density in hardened state. The cement–sand based non- autoclaved preformed foamed concrete has relatively higher density and higher requirement of cement content. Greater the proportion of aggregate, higher will be the density. Alternately, to achieve a particular density of foamed concrete, use of fly ash results in a reduction in foam volume requirement due to its lower specific gravity, therebyresulting in higher strength.

d. Thermal Conductivity

The AAC blocks thermal conductivity was determined using the Climate Chamber and a heat flux-meter. The Dual Climate Chamber (Fig. 1) creates two distinct habitats (warm and cold), which are separated by relative humidity (RH) and temperature. In the warm chamber the RH and the temperature vary between 10% - 95% respectively 5% - 100ºC and in the cold chamber the RH and the temperature vary between 15% - 95%, respectively, 45% - 100ºC. For measuring the heat flow intensity and the surface temperature was used a TRSYS01 heat flux meter and a Testo 616 electric humidity meter. The LWC blocks, with de dimension 150 × 150 × 150 mm, sample 1, were placed in the space between the two climate chambers using a guard ring. The position of the heat flux plates and of the thermocouples. In order to drying them, the LWC blocks were placed in the climate chamber at a temperature of 80°C and relative humidity of 10% for 72 hrs. The resulting RH of the blocks was 5.5% as determined using the electrical humidity meter Testo 616.

5. Conclusion

In comparison to normal clay bricks, Light Weight Concrete blocks have a 32 percent reduction in self-weight and a 36 percent increase in compressive strength after 28 days of curing. The compressive strength of the protein-based foaming agent in LWC blocks is higher than that of the aluminium powder foaming agent, but the thermal insulation and self-weight of the block are lower, we can select LWC blocks with aluminium powder. According to the above data, the water absorption capacity of blocks is also quite low when compared to other traditional bricks and LWC using protein-based foaming agent. The practicality of light weight foamed concrete with better exposure to elevated temperatures and thermal comfort for occupants has been shown in a study. This product's superior performance in a hostile chemical environment is a plus.

6. References

1. Ismail, I., Saim, A. A., & Saleh, A. L (2013), “Properties of hardened concrete bricks containing expanded polystyrene beads”. In Proceedings of the 5th Asia Pacific Structural Engineering and Construction Conference.
2. Arshad, M. S., & PAWADE, D. P., (2014). “Reuse of natural waste material for making light weight bricks”, International Journal of Scientific & Technology Research.
3. Kumar, R., & Ashish, D. K. (2014). “Study of properties of light weight fly ash Brick”. International Journal of Engineering Research and Application (IJERA).
4. Kartini, K., Norul, E., & Noor, B. (2015). “Development of lightweight sand-cement bricks using quarry dust, rice husk and kenaf powder for sustainability” International Journal of Civil & Environmental Engineering.
5. Mandlik A., Sood S T, Karade S, Naik S, Kulkarnins A (2015) “Lightweight Concrete Using EPS “International Journal of Science and Research (IJSR) Volume 4 Issue 3, March 2015.
6. Gawale, R., Mishra, S., Sambare, H., Kothari, J., & Patil, A. P. M., (2016) “Light Weight Concrete By Using Eps Beads” international journal of innovative research.

7. Day, K.W. (1996). Computer control of concrete proportions. Concrete international.
8. de Larrard, F.; and Sedran, T. (1996) Computer-aided mix design: predicting final result. ACI: Concrete International, 18(12), 39-41. 7. Peyfuss, K.F. (1990) Simplifying concrete mix design with the PC. ACI: Concrete international.
9. Abdullahi, M.; Al-Mattarneh, H.M.A.; and Mohammed, B.S. (2009) Equations for mix design of structural lightweight concrete. European Journal of Scientific Research.
10. Mindess, S.; Young, J.F.; and Darwin, D. (2003). Concrete. (2nd Ed.), New Jersey: Pearson Education, Inc.
11. Manoj, (2015)- "An experimental work on cellular light weight concrete", volume-02, issue-03, march-2015.
12. Anik, et.al (2016) "Comparative study of performance of light weight concrete" in: https://www.researchgate.com.
13. Effect of Aluminium Powder on Light-weight Aerated Concrete Properties Lam TangVan1,2,* , Dien Vu Kim1
14. Degirmenci, N., Utilization of phosphogypsum as raw and calcined material inmanufacturing of building products. http://dx.doi.org/10.1016/j.conbuildmat.
15. Tesárek, P., Drchalová, J., Kolísko, J., Rovnaníková, P. & Černý R., Flue gas desulfurization gypsum: study of basic mechanical, hydric and thermal properties. http://dx.doi.org/10.1016/j.conbuildmat.
16. Demir, I. & Baspinar Serhat, M., Effect of silica fume and expanded perlite addition on the technical properties of the fly ash-lime-gypsum mixture. http://dx.doi.org/10.1016/j.conbuildmat.2007.01.011
17. Gencel, O., del Coz Diaz, JJ. & Sutcu, M., Properties of gypsum composites containing vermiculite and polypropylene fibers: numerical and experimental results. Energy and Buildings, 70, pp. 135–144, 2014. http://dx.doi.org/10.1016/j.enbuild.2013.11.047.
18. Kishore,et.al(2016)- "Foamed cellular Light concrete".
19. Kumar, et.al (2016)- "Study of Light Weight Cellular Block" in - International Journal for Scientific Research & Development| Vol. 4, Issue 03, 2016.
20. BS EN 992, Determination of the dry density of lightweight aggregate concrete with openstructure 1996.