Light Weight Bricks or Blocks – A State of the Art Review

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Introduction

The world is striving to develop materials that are sustainable, workable, have adequate strength and are economical. Light weight bricks or blocks come under the above said category that are revolutionizing the present construction industry. With the advent of framed structures, the role of walls is reduced to just an enclosure or a partition. For this reason, use of heavy clay bricks or stones are economically and structurally not feasible. There are many studies on the preparation of light weight bricks in the form of Autoclaved Aerated Blocks, Fly ash bricks etc. But, the study of light weight bricks or blocks has always been a fascinating subject due to the immense number of attributes it caters to. India is one of the leading producers of bricks, along with China, Pakistan, Bangladesh and Vietnam combined, produce 75% of the global demand of fired bricks. The replacement of traditional clay bricks with light weight bricks made of fly ash and other wastes is to reduce energy consumption involved in the manufacturing clay bricks. Also, it was reported that nearly 1000 million tons of solid waste is generated in India annually. This includes domestic waste, industrial waste, commercial waste etc. So, the usage of Fly ash, GGBS and other industrial wastes in producing light weight bricks would definitely reduce the environmental pollution and also decrease the energy consumption that would incur in the production of traditional fired clay bricks. The present study is a state of the art review on light weight bricks or blocks that would conglomerate various ideas and thereby give a possible recommendation for a new light weight brick or block generation.

Materials and Methods

The various alternative materials like flyash, GGBS, Paper waste etc can be used for the preparation of production of light weight bricks or blocks. These materials are not only eco-friendly, but, they also contribute to the GHG's by reducing the usage of cement.

Flyash is an industrial waste obtained from the combustion of coal in thermal power plants. Depending upon the CaO content it is classified as Class F and Class C. Class C for high amount of calcium oxide and Class F for low amount of calcium oxide. Also, in micro level it appears in the form of spheres that helps in the workability of the concrete or cement mix in which it is used.

GGBS is a by-product of the iron and steel industry. It is glassy in nature and due to its high reactivity it can replace cement to a great extent up to 30-60% to make Slag cement. Also, it has pozzolanic reactivity that makes it to be used as a mineral admixture in ready mix concrete as well.

Light weight aggregate can be natural like pumice and Scoria or they can also be artificial obtained from expanding shale, slate, perlite, Vermiculite etc. The usage of these aggregates in the making of concrete makes it less dense to as low as 300 Kg/m^3**.**

Foaming agent: The synthetic –enzyme based foaming agents, foam stability enhancing admixtures and specialised foam generating equipment made easy to incorporate stabilised air bubbles in mortar that making it light weight to a density as low as 300 Kg/ m^3.

Method: The above materials depending upon their availability, different types of light weight bricks or blocks are manufactured. Some of the leading light weight bricks that are being manufactured currently are Autoclaved Aerated Concrete (AAC) blocks and Cellular Light Concrete Blocks (CLC). In AAC, the blocks are autoclaved for 10-12 hours and then cooled to get the desired blocks. In the case of cellular light weight concrete bricks, traditional concrete making methodology of mixing, casting, and then curing are considered and the desired blocks are cast. Also, technical skill is required in designing the mix proportions of light weight brick. Once the mix proportions are fixed, any unskilled labour under the supervision of semi-skilled labour can carry out the manufacturing process.

Cost: The cost analysis is performed as per Standard schedule of rates 2019-2020 of Telangana state. Table 1 shows the cost comparison between burnt clay bricks and other light weight bricks along with the number of bricks required for a 0.23 meter wall of 3.2 meter height.

Table 1. Cost to weight of bricks or blocks per running meter of wall for burnt clay brick and other light weight bricks.

Type of Brick	Density (Kg/m^3)	Weight (Kg)	Number of bricks per Running Meter (No's/Rm)	Cost per Rm	Cost/unit wt
Burnt clay brick (230mmx110mmx70mm)	1800	3.18	416	3325	1045.6
Fly Ash brick (290mmx225mmx140mm)	1400	12.79	81	2489	194.60
AAC Block (600mmx200mmx230mm)	600	17.11	27	3634	212.40
CLC Block (600mmx200mmx230mm)	775	21.40	27	6454	301.60

From the above (Table 1) it is clear that the cost/wt of AAC and CLC blocks is more compared to flyash bricks.

Advantages of alternate Light Weight Bricks: Along with the cost, the following some of the inherent advantages in using these light weight bricks irrespective of its type

- The low energy consumption and pollution free.
- The light weight bricks have a density as low as 800 kg/m^3 as compared to normally burnt clay bricks whose density is 1900 Kg/m^3. Due to this, a tremendous reduction in weight of walls leading to structural saving can be achieved in high rise buildings.
- The light weight bricks also show better thermal and sound insulation properties compared to burnt clay bricks. Also, the ease of working and casting to any shape is possible in case of light weight bricks which is a great challenge in case of burnt clay bricks.

Results and Concluding Remarks

1. The light weight bricks or blocks that are produced reduce the weight of wall to a great extent even up to 50% in terms of density and cost.
2. The blocks are light in weight, transportation and handling at site locations become easy. Thereby, cycle time of construction of walls is reduced in any framed type constructions.
3. Light weight bricks or blocks due to the presence of inherent voids provide the thermal and sound insulated environment.
4. Light weight blocks are helpful in constructing highly fire resistant structures that could withstand fire to about 5 hours and even more.
5. Compared to the traditional burnt clay bricks they cannot be used widely in the construction of load bearing walls. This can be mitigated by increasing the density of blocks reducing the entrained voids.

References

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