COMPARATIVE STUDY ON AUTOCLAVED AERATED CONCRETE BLOCK AND CONVENTIONAL BURNT CLAY BRICK

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***Abstract*—**The main objective of this paper is to comparing the autoclaved aerate light weight concrete block with conventional brunt clay brick according to their physical properties such as, density, water absorption and compressive strength. In most of the cases Autoclaved aerated Concrete block is stronger than a conventional brick made of clay. Brick and Cement are majorly used materials in building industry. Burnt brick is majorly use exterior wall material in the building construction. Also, autoclaved aerated concrete (AAC) is a noncombustible, cementatious building material that is expanding into new worldwide markets. Here we aimed to compare the burnt clay brick and AAC block used for building construction on the basis of standard testing procedure are to be tabulated and then conclusions are made by their best performance.

Key words: Conventional Burnt Clay Brick,
Autoclaved Aerated Concrete block (AAC block)

I. INTRODUCTION

Bricks are one of the most important building materials. In recent years, with expanding urbanization and increasing demand for construction materials, brick kilns have grown to meet the demand. It has directly or indirectly caused a series of environmental and health problems. At a global level, environmental pollution from brick-making operations contributes to the phenomena of global warming and climate change. Also, extreme weather may cause degradation of the brick surface due to frost damage. Global warming and environmental pollution is now a global concern. Various types of blocks can be used as an alternative to the red bricks, to reduce Environmental pollution and Global warming.[5] Autoclaved Aerated Concrete (AAC) blocks may be one of the solutions for brick replacement. Autoclaved Aerated Concrete (AAC) is one of the certified green building materials[6], which can be used for commercial, industrial and residential construction. It is porous, non-toxic, reusable, renewable and recyclable. AAC was developed in 1924 by a Swedish architect[2], who was looking for an alternate building material with properties similar to that of wood having good thermal insulation, solid structure and easy to work with, but without the disadvantage of combustibility, decay and termite damage. As AAC block uses fly ash, sand as main raw material, cement, lime as accessory materials, aluminum powder as forming agent, it refers to foaming through chemical reaction. It is one kind of new type green warm preservation wall material formed through raw materials grinding, batching and mixing, pouring and foaming, quiet stop and cutting, autoclave curing processes. It has light weight, high strength, good durability, heat preservation, sound insulation, fire proof, impervious, and good anchoring properties[1].

II. MATERIAL AND STANDARD SIZE

A. Conventional burnt clay brick

A brick can be composed of clay-bearing soil, sand, and lime, or concrete materials. Bricks are produced in numerous classes, types, materials, and sizes which vary with region and time period, and are produced in bulk quantities. Two basic categories of bricks are fired and non-fired bricks. Fired bricks are one of the longest-lasting and strongest building materials, sometimes referred to as artificial stone, and have been used since 210 B.C[1]. Air-dried bricks, also known as mud bricks, have a history older than fired bricks, and have an additional ingredient of a mechanical binder such as straw. Size of Standard brick as per Nepal Building code is 240mm*115mm*57mm including 10mm thick mortar. [12]

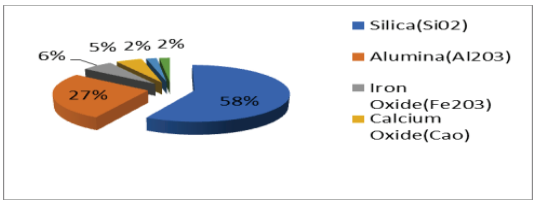

Fig. 1 Composition of burnt clay brick

B. AAC block

Block is a similar term referring to a rectangular building block composed of similar materials, but is usually larger than a brick. Lightweight bricks (also called lightweight block Or AAC blocks) are made from expanded clay aggregate or concrete. AAC was perfected in the mid-1920s by the Swedish architect and inventor Dr. Johan Axel Eriksson, working with Professor Henrik Kreüger at the Royal Institute of Technology[3]. Size of AAC blocks as per Indian Standard are 600mm*200mm*100/150/200 mm.[10]

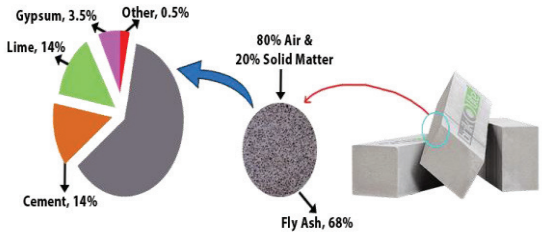

Fig.2; composition of AAC Block

III. STANDARD TEST

Comprehensive set of unit properties which are known to markedly influence building design and construction, and affect the structural performance of constructed building block and its durability. It identifies three physical properties based on *Indian standard*. [11] These properties include;

A. Density

B. Water Absorption.

C. Direct Compressive Strength

A. Density Test

The density is the ratio between the mass of the porous solid and its apparent volume, which includes pores, cracks and any internal empty spaces. Lower bulk density means a larger volume of empty spaces or pores, hence better thermal insulation. Moreover, the lower the apparent density, the lower the loads on the structural system, which, in its turn, will lead to structural elements with smaller sections and lower reinforcing steel consumption. It is well known that the seismic force a building bears during an earthquake is commensurate with the mass of that building, so it would be ideal to construct buildings which are as light as possible, while meeting all the standards of safety and comfort.

Density= Weight / Volume

B. Water Absorption Test

A standard soaking-in-water test can determine the porosity of bricks and blocks, which can then be used as an indication of the potential for the development of problems related to the penetration of salts and other materials into the units, such as salt attack and efflorescence. Initial rate of absorption As soon as the bricklayer puts the mortar on a brick, the brick starts to absorb water out of the mortar. The microscopic pores in the brick soak up the water, which carries with it some of the partly-dissolved cement and lime. It's the setting of this cementious material within the brick pores that provides most of the bond between the brick and the mortar, and thus gives the wall its strength.

%age water absorption= (Wet weight-oven dried weight/Oven dry weight)* 100

C. Direct Compressive Strength test

It is the tension to which a material breaks down after being subjected to compression. Higher compressive strength yields higher bearing capacity, therefore smaller wall sections (which use less material), in the case of selecting a structural system with loadbearing masonry walls If the structural system of the building is on frames (boards, beams and columns that take all forces that can be exerted on the building) or on concrete structural walls, the compressive strength of the material is irrelevant, since they do not serve a structural purpose, the only load they need to take is their own weight and the one of the finishing to be applied.

Compressive Strength= Ultimate Compressive load/Contact area

IV. RESULT AND DISCUSSION

For carrying our comparative study of AAC block and Brunt clay Brick, systematic experimental study was been carried out. For this, different lab tests only clay brick and AAC block was been undertaken. For finding out physical characteristics of AAC block, lab test to determine the average value of density, moisture content and compressive strength of AAC block and brunt clay brick was undertaken. The experimental results are shown in Table.

Table 1; Properties of brunt clay brick

Sample No.	Dimension in meter (L*B*T)	%age water absorption	Density (Kg/m^3)	Compresive strength (N/mm^2)
1	.22*.10*.051	14.98	1594.47	4.32
2	.225*.105*.055	15.24	1423.76	3.70
3	.223*.105*.055	14.95	1381.39	3.95
	Average	15.06%	1466.54	3.99

Table 2; Properties of AAC Block

Sample No.	Dimension in meter (L*T*B)	%age water absorption	Density (Kg/m^3)	Compresive Strength (N/mm^2)
1	.6*.2*.15	17.44	658.05	4.27
2	.6*.2*.15	17.41	656.89	4.29
3	.6*.2*.15	17.45	657.56	4.27
Average		17.43%	657.50	4.28

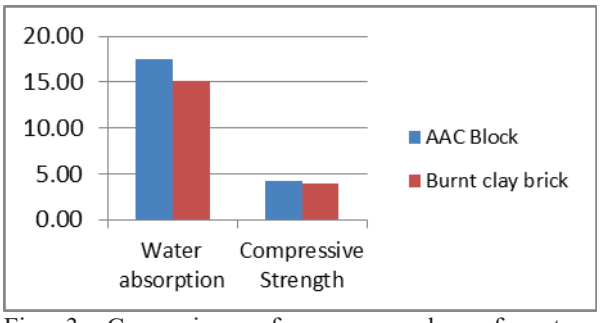

Fig. 3; Comparison of average value of water absorption and compressive strength

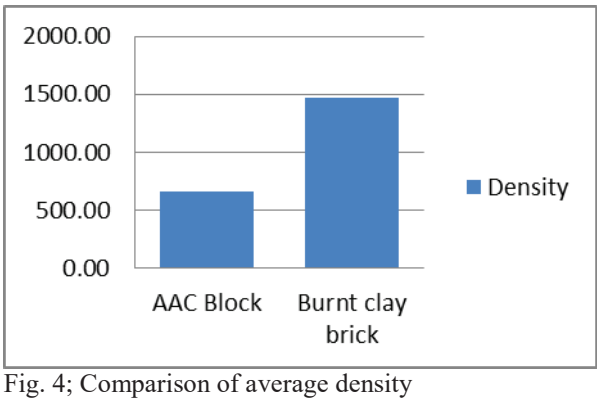

Fig. 4; Comparison of average density

From Table 1and 2, column chart as shown in Fig 4 is prepared for comparing the density of AAC block. It is found that density of AAC block is about 44.83 % that of traditional brick. This shows that weight of AAC blocks wall have only 44.83% as compare with the brunt clay brick. This is best option for the earthquake resistance structure. Similarly, column chart as shown in Fig 3 is prepared for comparing the water absorption and compressive strength of AAC block. This shows that brunt clay brick wall slightly less absorbed water while curing of masonry is done. This is more beneficial in rainy season when wall continuously exposed to wet condition due to rain. Similarly average compressive strength of AAC block is found to be 4.28 N/mm^2 and that of conventional burnt clay brick is 3.99 N/mm^2. From the experimental values compressive strength of AAC block are better than brunt clay brick.

V. CONCLUSION

From above results and discussion, following conclusions are drawn regarding comparison of AAC block and brunt clay brick for building construction;

i) From the experimental results carried out in this study, it is observed that density of Brunt clay brick is comparatively more than AAC block. Therefore AAC block is best option for earthquake resistance structure.

ii) From the experimental results carried out in this study, it is observed that water absorption of Brunt clay brick is comparatively slightly more than AAC block. Therefore Brunt clay brick is slightly better than AAC block.

iii) From the experimental results carried out in this study, it is observed that compressive strength of AAC block is comparatively more than convetional clay brick. Therefore AAC block is better for load transfer.

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