A review on comparison of strength parameters between AAC blocks and clay bricks for building construction using STAAD Pro

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ABSTRACT
The Autoclaved Aerated Concrete (AAC) material was produced in 1924 in Sweden. It has turned out to be a standout amongst the most utilized building materials in Europe and is quickly developing in numerous different nations around the globe. AAC is delivered from the regular materials lime, sand, concrete and water, and a little measure of rising operator. In the wake of blending and trim, it is then autoclaved under warmth and weight to make its interesting properties. AAC has great warm protection and acoustic ingestion properties. AAC is fire and irritation safe, and is monetarily and ecologically superior to the more customary basic building materials, for example, solid, wood, block and stone. AAC blocks are lightweight and offer ultimate workability, flexibility, and durability. Its composition includes sand, water, quicklime, and cement. AAC offers fantastic chances to expand building quality and in the meantime lessen costs at the development site. Therefore of its brilliant properties, AAC is utilized as a part of many building developments, for instance in private homes, business and mechanical structures, schools, healing facilities, lodgings, and numerous different applications.

Keywords—Autoclaved Aerated Concrete (AAC), Lightweight, Conventional brick, Reinforced steel, Save, Reduce

1. INTRODUCTION
Autoclaved Aerated Concrete (AAC) is one of the eco-friendly and certified green building materials. AAC is porous, non-toxic, reusable, renewable and recyclable. Autoclaved Aerated Concrete is a lightweight, load-bearing, high insulating, durable building product, which is produced in a wide range of sizes and strengths. The Autoclaved Aerated Concrete material was invented by a Sweden Architect, Johan Axel Eriksson in 1924. It has become one of the most used building materials in Europe and is rapidly growing in many other countries around the world. AAC is produced out of a mix of quartz sand or pulverized fly ash, lime, cement, gypsum/anhydrite, water, and aluminium and is hardened by steam-curing in autoclaves. Due to its excellent properties, AAC is used in many building constructions, such as in residential buildings, commercial and industrial buildings, schools, hospitals, hotels, and many other applications. AAC replaces clay bricks which are environmentally unsustainable. Being aerated, it contains 50 - 60 % of air, leading to lightweight and low thermal conductivity. The characteristic of AAC is helpful in green housings and saves fertile lands and a solution for fly ash disposal.

AAC is produced from the common materials lime, sand, cement and water, and a small amount of rising agent. After mixing and moulding, it is then autoclaved under heat and pressure to create its unique properties. AAC has excellent thermal insulation and acoustic absorption properties. AAC is fire and pest resistant, and is economically and environmentally superior to the more traditional structural building materials such as concrete, wood, brick, and stone.

AAC Blocks is a unique and excellent type of building material due to its superheat, fire and sound resistance. AAC blocks are lightweight and offers ultimate workability, flexibility and durability. The chemical reaction due to the aluminum paste provides AAC its distinct porous structure, lightness, and insulation properties, completely different compared to other lightweight concrete materials.

2. AAC BLOCKS– INDIAN SCENARIO
AAC consists of basic materials that are widely available. These include sand, cement, lime, gypsum, water, and an expansion agent. Silica sand, the raw material used in the
3. APPLICATION OF AAC

The most popular application of Autoclaved aerated concrete is AAC blocks. They are widely used for non-load bearing wall constructions. Various sizes of AAC blocks are used in the construction of dwellings and low-cost housing units on the mass scale. Autoclaved aerated concrete is used preferentially in external walls because of its outstanding insulation properties. In many places, entire residential areas are built using autoclaved aerated concrete. One very big reason for this is the ease of application, even for the non-professional, thus enabling a high level of personal contribution and resulting in a reduction of building costs. Autoclaved aerated concrete can also be used for internal walls. Because the walls are so level, they can be finished with a very thin coat of plaster.

Today, manufacturing light and heavy reinforced AAC elements is still a big challenge for the majority of world producers, primarily with tilt-cake technologies. But with time physical properties of AAC material improved and application became more universal, from a construction point of view. Today, AAC is a structural solid building material, excellent thermal insulator, good sound absorber and also an attractive decoration material. Additionally AAC products are manufactured with high-precision which can be finished on-site with a thin bed mortar (glue) instead of a thick layer of standard mortar, allowing minimizing the total cost of construction. The presence of smooth AAC product surfaces as a result of fast and cost-effective finishing is possible. AAC also offers a solution to safe building in seismically active zones, such as Japan, where a rocking AAC panel design offers buildings a protection up to 8 on a Richter’s scale. Another grand AAC development is aircrete panels with increased sound absorption properties, so-called Shizukalite boards, and a solution which offers an extra comfort of soundproofing for any type of sound-sensitive environments. In contrary to conventional AAC independent pore structure; these AAC panels have continuous open pore structures providing an opportunity for ideal acoustic absorption next to roads, HVAc’s, offices, etc. Application of AAC panels as firewall solutions (internal and external) further supports the universal building material image of aircrete as AAC can easily withstand up to 5-6 hours of direct fire exposure. With these modern products, AAC as a highly insulating and ecological material can contribute to largely popular “green housing” tendencies with a focus on energy efficiency, ultimately designing homes without energy appliances. Apart from this regular application, few new application of AAC is discussed below.

4. LITERATURE REVIEW

T M Prakash (2013) focused on estimating physical, strength and elastic properties of Aerated concrete block units. These included the Initial rate of absorption, density test, water absorption test etc. The compressive strength, modulus of elasticity and the flexural strength of the units were obtained. There is scanty information on the physical, strength and elastic properties of Aerated concrete blocks. The present investigation has endeavored to study all such properties. Having obtained the results, it would now be interesting and useful to compare the results with that of conventional masonry units.

A. J. Hamad (2014) classified aerated lightweight concrete into foamed concrete and autoclaved concrete. Also, it exhibits the raw materials used in aerated concrete, types of agent, properties, and applications. The production method is classified for each foamed and autoclaved concrete. The literature review of aerated lightweight properties focuses on the porosity, permeability, compressive strength and splitting strength.

F. M. Saiyed et al (2014) deals with the introduction to the process of the autoclaved aerated concrete and its advantages compared to the normal concrete.

S. O. Rathi and P. V. Khandve (2015) replaced the red bricks with eco – friendly AAC blocks. The usage of AAC block reduces the cost of construction by up to 20% as a reduction of a dead load of the wall on beam makes it comparatively lighter members. The use of AAC block also reduces the requirement of materials such as cement and sand up to 50%.

A. Habib (2015) presented the potentiality and formation techniques of aerated concrete in the context of Bangladesh. In this experiment, the generation method of hydrogen gas was used for the aeration process. In this gasification method, a finely powdered aluminum powder was added to the slurry of Ordinary Portland cement with different percentages such as 0.05%, 0.1%, 0.15%, 0.2%, and 0.25%. To determine the effect of aluminum powder on the final product properties, some test has been conducted such as density, water absorption, and a compressive strength test. However, it was observed that the concrete having 0.15% aluminum powder contributes in the strength gaining process of aerated concrete.

S. Dhole and N. Singh (2016) presented the research study of the project conducted to study the feasibility of setting up an AAC Blocks Manufacturing Plant. The object of this feasibility study is to provide a framework about the technical, economical & financial aspects in a broader sense and implementation of the project under the projected time-frame. In other words, the study is aimed at analyzing the Technical, Economical and Financial viability of setting up an AAC Blocks Manufacturing Plant. Fly ash is a major raw material source (65-70% of finished goods is fly ash) and by locating the plant almost adjacent to raw material source gives manifold advantage both logistically and commercially. The unit will be located in MIDC Bhusari which is having direct AAC to all corners of the country through 4-laned national highways. The land is ideally located as it can cater to Nagpur (about 25 Kms) and surrounding markets very conveniently the current presumptions will be adequate and necessary for the operation of 150,000 cu meter AAC unit. The plant design, OH cranes, rails have been planned in such a manner that the unit can double up its capacity simply by installing autoclaving chambers, with minimal changes in the infrastructure in the years to come.

G. Kumawat et al (2016) showed the analysis and comparison between the two same G+12 building with different material in terms of bricks. The bricks which are taken for first building...
analysis is burnt clay bricks and for second building analysis is cellular lightweight concrete blocks. This analysis is done by STAAD-Pro software and in result shows the reduction in overall cost of construction by using CLC blocks.

5. CONCLUSION

Aerated lightweight concrete is unlike conventional concrete in some mix materials and properties. Aerated lightweight concrete does not contain coarse aggregate, and it possesses many benefits such as low density with higher strength compared with conventional concrete, enhanced in thermal and sound insulation, reduced dead load in the could result in several advantages in decrease structural elements and reduce the transferred load to the foundations and bearing capacity. Foamed concrete is different in the agent of forming air-voids as compared with autoclaved aerated concrete. The air-voids in foamed concrete formed by foam agent, this operation is physical processing. Against the air-voids in autoclaved aerated concrete formed by the addition of aluminum powder to the other materials and reaction between them, and this operation is chemical processing. The air-voids are homogenous distribution within the aerated lightweight concrete. The compressive strength of foamed concrete can be developed reach to structural strength compared with autoclaved aerated concrete. Aerated lightweight concrete is considered the economy in materials and consumption of by-product and wastes materials such as fly ash.

The compressive strength of AAC blocks is comparatively more than traditional clay brick. These are suitable for walls in RCC framed building. Utilization of fly ash leads to the reduction in the cement consumption in the product which results in a reduction of greenhouse gases. The density of AAC block is 1/3 that of traditional clay brick and there is no more change in wet condition. It helps in reducing a dead load of the structure. Cost of construction reduces by maximum up to 20% as a reduction of a dead load of the wall on beam makes comparatively lighter members. As both side face of AAC block wall is plane, the thickness of plaster is very less, and so there is substantial reduction up to 50% in the requirement of cement and sand for plasterwork. AAC is manufactured from common and abundant natural raw materials, therefore it is extremely resource-efficient and eco-friendly. The energy consumed in the production process emits no pollutants and creates no by-products or toxic waste products. The workability of AAC helps to eliminate waste on the job site.

But to increase application of AAC product in various fields, an approach requires investment in high quality and automated equipment that uses the latest manufacturing technology. Hence, both existing manufacturers of AAC blocks and new investors that are looking to introduce AAC to their market should not limit themselves to a low quality and limited range of product output. Producing a complete AAC solution is a next step towards the market expansion and increasing market share of AAC as a building material. Investments in innovative plant upgrades and new plants with modern AAC technology are essential to staying ahead of the ever-changing construction market.

6. REFERENCES