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A Review on Autoclaved Aerated Concrete (Aerocon bricks)

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A B S T R A C T

Low-cost housing can be built using efficient planning and project management, affordable building materials, cost-effective building techniques, and other available construction alternatives. By creating new structures or improving existing ones, the choice of building materials should take into account the needs of the local environment in order to increase the quality of life for those who are most desired. According to numerous studies, a wide range of wall materials have been used in various building systems using both traditional and modern construction techniques. However, only a small number of these materials (extruded clay bricks, hollow concrete blocks) have been successfully used in low-cost housing projects. The contemporary real estate age has matured, and Aerocon bricks have taken the role of clay bricks and mortar as an alternate building material.

OBJECTIVE

Autoclaved Aerated concrete blocks used in the construction of walls. The raw materials used in the manufacture of these blocks are environmentally friendly and are certified green products

Keywords: Advanced construction technology, construction industry and innovations

1. INTRODUCTION

This Autoclaved Aerated concrete is also known as autoclaved cellular concrete (AAC) bricks, Autoclaved lightweight concrete (ALC) bricks and Autoclaved aerated bricks (AAC). These AAC bricks are made with a mixture of cement, fly ash, lime, aeration agents and water involving an aeration process that gives it the unique cellular structure.For environmentally conscious it means eco-friendly products and for those who occupy buildings with AAC blocks it means better safety and lower energy costs for cooling or heating.Thousands of tons of fly ash is generated by thermal power plants every day and its disposal is a cause of concern. Moreover, using fly ash does not harm the environment at all. In fact, using fly ash takes acre of issues related to disposal of fly ash. So, using fly ash to produce AAC products provides a sustainable, economic and environment friendly option. At the end, it all translates to a better world for future generations.

Fig 1 AAC Blocks

These AAC bricks are available in three sizes. They are:

1. **Infill bricks/blocks:**

The size of the infill AAC brick size is 600x600 mm and the thickness varies in the ranges of 75,100,125,150 and 200 mm. the main advantage of these brick is that they can easily replace 60% of the concrete in roof slabs and thus help in saving significant amounts of concrete, steel, labor, water and plaster etc. these blocks are especially suitable for building roofs in large column constructions.

2. **Jumbo bricks:**

These are typically in the size of 600x200 mm and thickness ranges from 75,100,125,150 and 200 mm. it results in the usage of much fewer bricks and hence less mortar is required. These bricks are more suitable for non-load bearing walls, multi-storied buildings etc.

3. **Thermal bricks:**

These brick/blocks called as Aero cool thermal bricks whose size and thickness are 300x200 mm and 50mm respectively. These bricks are ideal for roofing, since they delay the transmission of heat flow and also keep interiors remain warm during winters and cool during summers.

2. CHARACTERISTICS OF AAC BRICKS

- **Light weight:**

The typical structure of AAC bricks resulted in light weight blocks. their weight is only one third the density of the clay bricks which makes them easy to handle on site. Reduces weight of bricks decreases the dead weight on the structure' hence AAC bricks are ideal for low load bearing soil and for seismic zones. Even for building additional floors in an existing building, AAC bricks are perfect choice as their less weight will not affect the stability of the structure.

- **Fire resistance:**

Walls build with AAC bricks, with a minimum thickness of 100mm can resist fire for up to four hours which make them the safe choice in construction. Especially for industries and companies, which are vulnerable to fire accidents, those blocks are of much help.

- **Sound insulation:**

These AAC bricks have higher sound insulation and a good quality AAC brick can minimize the sound transmission up to 42 decibels.

- **Strength and durability:**

These bricks made with higher weight ratio help in building stronger and economical structure. As they remain unaffected by the environmental conditions, they ensure longer life for the building.

- **Perfect finish and dimensional stability:**

The autoclaving process used in the manufacturing of AAC bricks gives perfect dimensions to the blocks along with low tolerances. Dimensionally perfect blocks help in building uniform, thin walls with perfect finish.

- **Quality control:**

As brick making is in India is an un-organized market, the quality of regular bricks often varies based on the manufacturer. Hence consistent quality control is an issue with traditional bricks which is not an issue with the AAC bricks.

3. MANUFACTURING PROCESS OF AAC BRICKS

There are several steps are to be considered for manufacturing of AAC bricks. They are:

Step-1: Raw material preparation:

The mix proportion used 1:3 with a water-cement ratio of 0.6. in this research, the specimen is tested with and without lime. List of raw materials and relevant details are mentioned below:

a. Fly ash:

Key ingredient for manufacturing of AAC bricks is silica rich material like fly ash, pond ash or sand. Fly ash slurry is created by combining fly ash with water.Slurry thus formed is mixed with other ingredients like lime powder, cement, gypsum, and aluminum powder in quantities consistent with the recipe.

Fig 2 AAC block Raw materials

b. Lime powder:

It is obtained either by crushing limestone in the AAC factory to a fine powder or by buying it straight from a seller in powder form.

c. Cement:

In this AAC bricks, 53 grade OPC is used from reputed manufacturer is required for manufacturing of AAC blocks. Cement supplied by 'mini plants' is not recommended due to drastic variations in quality over different batches.

d. Gypsum:

It is easily available in the market and used in powder form.

e. Aluminum powder/paste:

It is easily available from various manufacturers. A very small quantity of aluminum powder is required to be added to the mixture, it is usually weighed manually and added to the mixing unit.

Step-2: Dosing and mixing:

In this unit is used to form the concrete mix to produce AAC bricks. The slurry of fly ash is pumped into a different container. Pumping is halted once the desired weight has been pumped in. Similarly lime powder, cement and gypsum are put into individual containers using screw conveyors. Once required amount of each ingredient filled into their individual containers control system releases all ingredients into mixing drum. Mixing drum is like a giant bowl with a strainer rotating inside to ensure proper mixing of ingredients. Steam might also be fed to the unit to maintain temperature in range of 40 to 42^0C.a smaller bowl structure used of feeding aluminium powder is also attached as a part of mixing unit. For AAC bricks manufacturing, entire dosing and mixing operation is completely automated and requires minimum human invention. These operations are continuous because if there is a significant lag between loading and unloading materials, residual mixture could start to solidify and clog the entire system.

Step-3: Casting, rising, and Pre-curing:

After through mixing, slurry containing fly ash, lime powder, cement, gypsum, and aluminium is poured in moulds. Depending on the installed capacity, moulds can come in a variety of sizes. Before casting, a small layer of oil is applied to the moulds. To prevent green cake from sticking to the moulds, this is done.Usually rising and pre-curi8ng pro0cess takes around 60-240 minutes. Rising is dependent on raw material mix and weather conditions. It should be noted that weather is a major factor affecting rising process. It should be ensured that green cake is not subjected to vibrations during pre-curing or else it might develop cracks.

Step-4: De-moulding and cutting:

De-moulding and cutting are very critical processes in AAC bricks manufacturing. Both the quantity of rejection and the end product's dimensional accuracy are greatly influenced by these two procedures. A mould is lifted by a crane or rolled on rails for the demoulding process once it has left the pre-curing chamber. Lifting or rolling green cake is determined by technology deployed. Horizontal cutting machine does not have any moving parts. Green cake is cut by being moved through a horizontal cutting machine.

4. COMPARISON BETWEEN AAC BRICKS AND CLAY BRICKS

Parameters	AAC bricks	Clay bricks
Soil consumption	Zero soil consumption	1 sq. ft of area with clay bricks
Labor	Organized sector with HR practices	Unorganized sector with the use of child labor
Production facility	State of the art factory facility	Unhealthy working conditions due to toxic gases
Compressive strength	3-4N/m^2	2.5-3N/m^2
Fire resistance (8" wall)	Up to 7 hours	Around 2 hours
Cost benefit	Reduction in dead weight loading to savings in steel and concrete	None
Thermal resistance	Approx 30% for heating and cooling	None
Speed of manufacturing	High	Low

5. CONCLUSION

As a construction system, AAC provide significant environment and other benefits for the building owner. The short- and long-termeffect of using AAC compared to many other materials results in lower energy consumption, reduced operating costs, greater safety and comfort, and a healthier and more trouble free building. These features provide a better investment for building owner and for environment.

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