

A STUDY OF AUTOCLAVED AERATED CONCRETE BLOCK AS A ALTERNETIVE BUILDING CONSTRUCTION MATERIAL

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ABSTRACT

Economy of structure is one of the basic aspect upon which any design is based. Stability plays an important role but best designer is one who comes out with a design which gives the stable and economic structure. The development of construction technology is closely related to the development of adequate mechanization and handling technology. Autoclaved aerated concrete block is an important addition to the types of masonry units available to the builder and its use for masonry is a constantly increases. An investigation on construction of Autoclaved aerated concrete block masonry emphasizing in the present to study the crack patterns developed in the structural elements such as wall. Though the strength of wall constructed with Autoclaved aerated concrete block give the less strength as compared to brick masonry but cost of construction is very less.

Pre cast Autoclaved Aerated Concrete is a Lightweight, Load-bearing, High-insulating, Durable building product, which is produced in a wide range of sizes and strengths. AAC Blocks is lightweight and compare to red bricks AAC Blocks are three times lighter.

Keyword:- Light weight, economic, More productive, Fire resistance, durable building product

1. INTRODUCTION

Shelter is one of the three basic requirements of human being. Initially ancient man started living in caves excavated below ground level on near the hill ends. Thereafter, they started constructing walls from mud, and in due course of time, the developed the techniques of burnt clay brick masonry to form the s structural part of the shelter.

As building development throughout the world continues, the desire to construct cheaper structures on sites that are more difficult to build on, in shorter periods of time, all while providing improved performance will always be desirable in order to maximize both product economy and quality. As such, the construction industry is constantly searching for ways to improve their product. One means to this end is, rather than relying on improving construction implementation mechanisms such as scheduling, installation techniques, and quality control, is focusing on the industry's improved knowledge and development of materials and their behavior.

The AAC blocks are made of common materials lime, sand, cement and water, and small amount of rising agent. 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.

2. MARKET DEMAND

As the construction activity is growing day by day, there is a good demand for AAC blocks. These blocks find wide applicability and construction cost is largely reduced. It requires mainly by Govt. Departments and industries.

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3. MANUFACTURING PROCESS

Cement concrete blocks are solid (dense). Besides different sizes and designs can be given to the blocks. The blocks are made in the sizes of 625 x 240 x (75 to 300)mm. Firstly cement, stone chips, sand, etc. are mixed in the ratio of 1:6 or 1:12. This mixture is put in vibrator machine. This is then poured into the desired size mold. After 24 hours of drying, the blocks are put in water tank for curing. The process of curing continues for two to three weeks to give the blocks compression strength. The blocks are used in construction process after drying.

It is easy to make a concrete block. The successful block yard must however make blocks of uniform quality and sell them at a price high enough to cover costs and make a reasonable profit.

4. SIZE

The site should be big enough for aggregate stockpiles, cement storage, production (lab or stationary machine), block stacking, staff facilities, an office and on-site access.

Provided concrete masonry units complying with requirements indicated below for size are manufactured to specified face dimensions within tolerances specified in applicable referenced ASTM specification. A manufacture concrete masonry unit specified dimensions of 3/8 inch less than nominal widths by nominal heights by nominal lengths. Provide special shapes where indicated and as follows.

A. For Lintels, corners, jambs, sash, control joints, headers, bonding and other special condition.



Fig.-1: AAC BLOCK

5. MATERIAL FOR BLOCK MAKING

5.1 Cement

53-grade Ordinary Portland Cement (OPC) from reputed manufacturer is required for manufacturing AAC blocks. Cement supplied by 'mini plants' is not recommended due to drastic variations in quality over different batches. Some AAC factories might plan their captive cement processing units as such a unit can produce cement as well as process lime. Such factories can opt for 'major plant' clinker and manufacture their own cement for AAC production. Cement is usually stored in silos.

5.2 Flyash or sand

Key ingredient for manufacturing Autoclaved Aerated Concrete (AAC) blocks is silica rich material like fly ash, pond ash or sand. Most of the AAC companies in India use fly ash to manufacture AAC blocks. Fly ash is mixed with water to form fly ash slurry. Slurry thus formed is mixed with other ingredients like lime powder, cement, gypsum and aluminum powder in quantities consistent with the recipe. Alternately sand can also be used to manufacture AAC blocks. A 'wet' ball mill finely grinds sand with water converting it into sand slurry. Sand slurry is mixed with other ingredients just like fly ash slurry.

6. CASTING AND RISING

AAC blocks manufacturing process involves casting, rising and pre-curing. Once desired mix of raw materials is ready, it poured in molds. This process has different names. It is called casting, pouring or molding. For current discussion, we'll call it casting. After thorough mixing, slurry containing fly ash (or sand), lime powder, cement, gypsum and Aluminum is poured in molds. Molds can be of various sizes depending upon installed capacity. Standard molds for 160-500 m³/day are 4.2m x 1.2m x 0.65m in size. Some Autoclaved aerated concrete (AAC) blocks plant might have molds of 3m, 4.8m or 6m.



Fig.-2: BLOCK MOULD

7. PRE-CURING

Usually rising and pre-curing process 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. As reaction is affected by weather conditions, it is recommended to maintain constant temperature in pre-curing area. Due to this, pre-curing is also referred as '*heating room pre-curing*'. This can be achieved by deploying radiating pipes for indirect heating. It should be ensured that green-cake is not subjected to vibrations during pre-curing or else it might develop cracks.

At end of pre-curing process, green-cake is hard enough to be wire cut as per requirements. Pre-curing is not a complicated process, but it should be monitored constantly. Operators must monitor the slurry change during rising. Constant feedback must be provided to dosing, mixing and casting operators. Pre-form defects (cracking, sinking, etc) mainly occur during the process.

8. ADVANTAGES OF AAC BLOCKS

- Improved thermal efficiency reduces the heating and cooling load in buildings.
- Porous structure allows for superior fire resistance.
- Workability allows accurate cutting, which minimizes the generation of solid waste during use.
- Resource efficiency gives it lower environmental impact in all phases of its life cycle, from the processing of raw materials to the disposal of waste.
- Light weight saves cost & energy in transportation, labor expenses, and increases chances of survival during seismic activity.
- Larger size blocks lead to faster masonry work.
- Reduces the cost of the project.
- Environmentally friendly: When used, it helps to reduce at least 30% of environmental waste as opposed to going with traditional concrete. There is a decrease of 50% of greenhouse gas emissions. When possible, using autoclaved aerated concrete is a better choice for the environment.
- Fire resistant: Just like with regular concrete, AAC is fire resistant. This material is completely inorganic and not combustible.
- Lightweight: Concrete blocks that are made out of AAC weigh about one-fifth of typical concrete. They are also produced in sizes that are easy to handle for quick construction.
- Accuracy: The panels and blocks made of autoclaved aerated concrete are produced to the exact sizes needed before they even leave the factory. There is less need for on-site trimming. Since the blocks and panels fit so well together, there is a reduced use of finishing materials such as mortar.
- Long lasting: The life of this material is extended because it is not affected by harsh climates or extreme changes in weather conditions. It will not degrade under normal climate changes either.
- Quick assembly: Since it is a lightweight material and easy to work with, the assembly is much quicker and smoother.

9. PROPERTIES

9.1 Sound insulation

The porous structure of the AAC blocks results into enhanced sound absorption. The Sound Transmission Class (STC) rating of the AAC blocks up to 45 db. Thus, AAC blocks have been the most ideal material for the construction of walls in auditorium, hotels, hospitals, studios, etc.

9.2 Fire resistance

Depending upon the thickness of the Autoclaved Aerated Concrete (AAC) Blocks, they offer fire resistance from 2 hours up to 6 hours. These blocks are highly suitable for the areas where fire safety is of great priority.

9.3 Earthquake Resistant

The light weight property of the AAC blocks results into higher steadiness of the AAC blocks in the structure of the buildings. As the impact of the earthquake is directly proportional to the weight of the building, the building constructed using AAC blocks are more reliable and safer..



Fig.-3: AACBLOCK WALL**10. COMPRESSIVE STRENGTH**

The block has an average compressive strength of (3-4.5) N/mm³ which is superior to most types of light weight blocks, 25% stronger than other products of the same density.

**Fig -4: BLOCK FOR LOAD STRUCTURE****11. CONCLUSIONS**

The hollow concrete blocks of sizes 625 x 240 x (75 to 300) mm made with the concrete grade 13:6 proportions give the average compressive strength of 3 to 4.5 N/mm² considering the gross area. Considering the net cross-sectional area of the AAC blocks of size 625 x 240 x 200 mm made with the concrete grade 13:6 proportions give the average compressive strength of 4.5 N/mm².

The Blocks manufactured in this experimental program with granite fine particles as an additive ensures effective packing and large dispersion of cement particles which resulted in a good degree of surface finish and edges.

It is evident from the results obtained that Key ingredient for manufacturing Autoclaved Aerated Concrete (AAC) blocks is silica rich material like fly ash or sand. Flyash is mixed with water to form fly ash slurry. Slurry thus formed is mixed with other ingredients like lime powder, cement, gypsum and aluminum powder in quantities consistent with the recipe. Alternately sand can also be used to manufacture AAC blocks.

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