

REPLACEMENT OF CLAY BRICKS BY AUTOCLAVED AERATED CONCRETE BLOCKS IN BUILDING CONSTRUCTION

Himanshu Yadav¹, Ram Shran Takhar², Pankaj³

¹Asst. Professor, Department of civil Engineering, Pratap Institute of Technology & Science Sikar

²H.O.D, Department of civil Engineering, Rajasthan Institute of Engineering and Technology Jaipur

³B.Tech scholar, Department of civil Engineering, Pratap Institute of Technology & Science Sikar

Abstract— In the history of building construction brick is one of the oldest of all material. Bricks are very widely use building material because cost of bricks is very cheap and manufacturing of bricks is very simple. Generally, we use bricks in partition wall and main wall of building. strength of brick is satisfactory for building construction. Brick masonry is an easy masonry technique as compare to stone masonry technique but we required more new technology in construction work. Brick masonry and stone masonry take more time in construction of wall and other components of building. So, we required new masonry technique for building construction. In now days most of countries use AAC Blocks instead of bricks. Autoclaved Aerated Concrete block is a light weight concrete block and weight of AAC block is 1/5 of concrete block so dead load of wall and other components is obviously decrease.

AAC block have more air bags so weight of AAC block is very less as compared to ordinary concrete block. Basic material of AAC block is widely available in nature. these include sand, cement, lime, fly ash, gypsum, aluminium powder and expansion agent. Autoclaved aerated concrete block contains 70% to 80% air and this air content change accordingly strength and density of AAC blocks. in the last decade, construction industry has been conducting various researches on the utilization of easily available raw materials in construction. AAC blocks are very good material for construction site because AAC blocks are energy efficient and environmentally friendly concrete. This paper introduces with the Autoclaved aerated concrete blocks and its advantages compared to other building materials.

Keywords—AAC, Aluminium, Fly ash, Cellular concrete, Lightweight concrete

I. INTRODUCTION

In this paper we introduce to Autoclaved aerated concrete (AAC). AAC block is a new technology in masonry construction in this technology we produce special type of concrete for manufacturing of blocks. These blocks have special type of characteristic so these blocks have good demand in construction industry. These blocks are porous and light in weight so these blocks decrease dead load of structure. AAC blocks have thermal resistance and sound resistance characteristic. Autoclaved Aerated Concrete (AAC) is one of the most commonly used light-weight construction materials for contemporary buildings, especially due to its low density, unique thermal and breathing properties and high fire resistance. Autoclaved aerated concrete structures also have earthquake resistant property. If we use AAC block in building construction then cost of building comparatively less than other traditional buildings and also time of construction of building is less than traditional building. in future Autoclaved aerated concrete completely replaces other material because AAC have good fire resistance, sound resistance, less in cost, less time consumption in construction of structures as compared to other building material like as stone, brick, wood and any other.

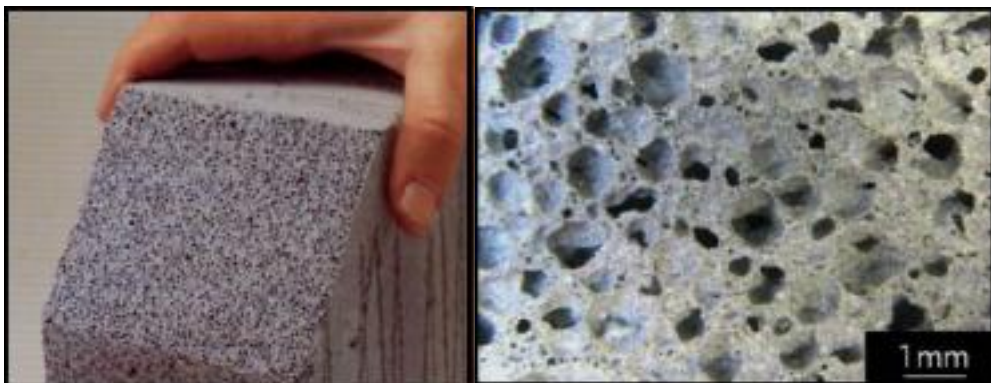
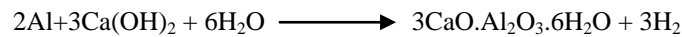


Fig. 1 Autoclaved aerated concrete block

II. RAW MATERIALS OF AAC BLOCKS

1. Cement: - Cement is a binding material which is use in construction of building and other structure. In Autoclaved Aerated Concrete we use OPC 53 grade of cement and density of cement is 1440 kg/m³.

2. Fly Ash: - Fly ash is waste industrial product used for reduction of construction cost. The density of fly ash ranges from 400-1800 kg/m³. It provides thermal insulation, fire resistance and sound absorption. The type of fly ash used is of Class C with contains 20% lime (CaO) and loss of ignition not be more than 6%.
3. Sand: - Sand is a crushed material of rock which is use in concrete as fine aggregate. We use fine sand as per codal provision IS 383:1970
4. Lime Stone: - Limestone is made up of calcite aragonite. Limestone is obtained either by crushing to fine powder at AAC factory or by directly purchasing it in powder form from a merchant.
5. Aluminium Powder: - Aluminium Powder mix in concrete and this powder works as an expansion agent. When the raw material reacts with aluminium powder, air bubble introduced due to reaction between calcium hydroxide, aluminium and water and hydrogen gas is released.



6. Gypsum: - Gypsum is easily available in the market and is used in powder form.

III. PHYSICAL PROPERTIES OF AUTOCLAVED AERATED CONCRETE: -

Some Physical properties of autoclaved aerated concrete is depending on density. The density of autoclaved aerated concrete classify in European Norms are show in table below:

TABLE 1
 DENSITY CLASSES OF AUTOCLAVED AERATED CONCRETE

S.no.	Density Class	Dry Density (kg/m ³)
1	300	>250 to <350
2	400	>350 to <400
3	500	>450 to <500
4	600	>550 to <600
5	700	>650 to <700
6	800	>750 to <800
7	900	>850 to <900
8	1000	>950 to <1000

AAC have wide range of density and no other industrial product that covers such a range in apparent density. In AAC we use 350 kg/m³ or more Density use for load bearing purpose and less than 350 kg/m³ density use for thermal insulation purposes. Density is related to water/cement material ratio of the mixture since it is related to the amount of aeration obtained. For a given density, water/cement ratio increases with proportion of sand.

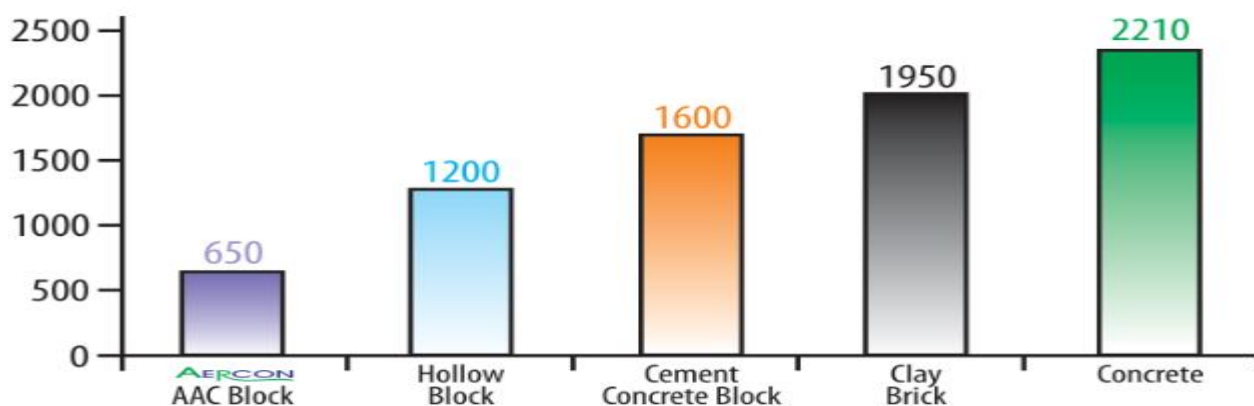


Fig. 2 Density comparison Autoclaved aerated concrete block

1) Size of Autoclaved Aerated Concrete: -

Generally used autoclaved aerated concrete size is 600mm X 200mm X (75mm to 300mm). Autoclaved aerated concrete block height is varying according to requirement of construction. Size of autoclaved aerated concrete is more than clay brick (230mm X 115mm X 75mm) so they are placed easily at location and cover more area as compared to clay brick. when we construct two walls of same size by autoclaved aerated concrete blocks and clay brick than we find that time

consumption in both walls are different and difference is surprisingly affecting our work tradition because autoclaved aerated concrete blocks wall takes just half time of clay brick wall. Working with autoclaved aerated concrete blocks is very simple and easy to understand.

2) *Compressive Strength of Autoclaved Aerated Concrete:* -

Compressive strength of autoclaved aerated concrete is more than general clay brick. Generally, we use clay bricks in building construction and these bricks compressive strength (2.3 N/m² to 3.5 N/m²) is less than AAC blocks compressive strength (3 N/m² to 4.5 N/m²).

3) *Normal Dry Density of Autoclaved Aerated Concrete:* -

Normal dry density of autoclaved aerated concrete is much less than general clay brick. Dry density of any material is directly affecting the water absorption capacity of material. Autoclaved aerated concrete blocks required less curing as compare to clay brick.

TABLE 2
 DRY DENSITY OF AUTOCLAVED AERATED CONCRETE

S.No.	Property	Autoclaved Aerated Concrete (kg/m ³)	Clay brick (kg/m ³)
1	Dry Density	550-650	1800

4) *Other Physical properties of Autoclaved Aerated Concrete:* -

Many physical properties of Autoclaved Aerated Concrete are use in engineering works. Different engineering properties are use in different works. Some Physical properties of Autoclaved Aerated Concrete are given bellow:

TABLE 3
 PHYSICAL PROPERTIES AUTOCLAVED AERATED CONCRETE

S.No.	Property	Autoclaved Aerated Concrete (kg/m ³)	Clay brick (kg/m ³)
1	Sound Reduction Index	45 Db for 200 mm thick Wall	50 Db for 230 mm thick Wall
2	Fire Resistance	2Hrs. to 6Hrs. (Depending on thickness)	2Hrs.
3	Thermal Conductivity (K)	0.16 W/m-k to 0.18 W/m-k	0.81 W/m-k
4	Drying Shrinkage	0.04%	-

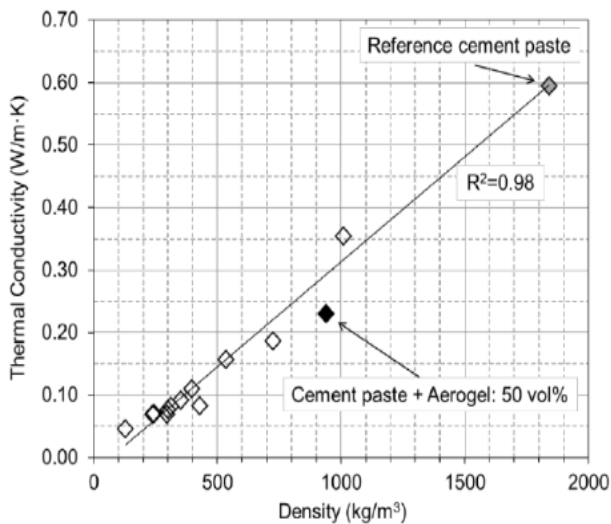


Fig. 3 Thermal conductivity of Autoclaved aerated concrete

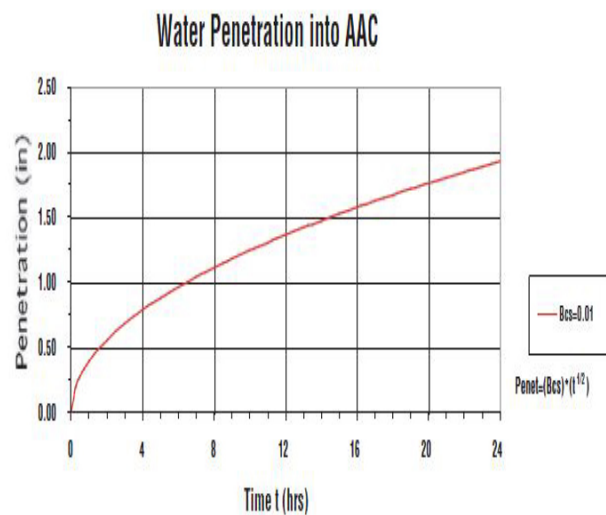


Fig. 4 Water Penetration result of AAC

IV. ECONOMIC CONSIDERATION

When we make a simple building than first factor which affect directly to owner is economic condition. Now days a building construction is a very difficult for medium economic condition family because cost of a simple building is very high and medium economic family can not bear cost of a building. If we use AAC block than cost of building decrease and strength also increase. Some Parameter are given below which show that how cost of building affected by AAC block.

- **Structural Cost:** - Every concrete structure require steel for bearing tensile load of structure. If we use Autoclaved Aerated Concrete in structure than we save up to 15% of steel.
- **Cement Mortar for plaster & masonry:** - Quantity of cement mortar is less required in Autoclaved Aerated Concrete Blocks because they have regular shape and less no. of joints as compare to clay brick.

- Breakage: - AAC blocks have good strength and light in weight so they do not break easily. AAC Blocks generally break less than 5% and clay brick break average 10 to 12%.
- Construction Speed: - Speed in construction of Autoclaved Aerated Concrete block is very fast as compare to clay brick. Autoclaved Aerated Concrete block have large size so speed of construction is obviously increase.
- Quality: - Autoclaved Aerated Concrete quality is very good because they are manufacture in industries and clay brick have average quality.
- Carpet Area: - Carpet area of Autoclaved Aerated Concrete is more because less thickness of walling material as compared to clay brick.
- Availability: - Autoclaved Aerated Concrete blocks available every time and clay bricks generally not available in monsoon.
- Energy Saving: - Autoclaved Aerated Concrete reduce air-conditioned load approx. 30%.
- Chemical composition: - Sand, Fly ash used around 60-70% which reacts with lime & cement to form Autoclaved Aerated Concrete and in clay brick soil is used which contains many inorganic impurities like sulphates etc. resulting in efflorescence.

V. CONCLUSIONS

- Compressive strength of AAC blocks is comparatively more than traditional clay brick.
- Density of AAC block is 1/3 that of traditional clay brick and there is no more change in wet condition.
- Autoclaved Aerated Concrete helps in reducing dead load of structure.
- Cost of construction reduces up to 30 %.
- The energy consumed in the production process emits no pollutants and creates no by-products or toxic waste products.
- The work ability of AAC helps to eliminate waste on the jobsite.

REFERENCES

- [1] Sawhney, A., Mund , A., Syal, M. , “Energy-Efficiency Strategies for Construction of Five Star Plus Homes.” The Practice Periodical on Structural Design and Construction, Vol. 7, 1, 2002. ©ASCE, ISSN 1084-0680/2002/4-174 – 181/\$8.002\$.50 per page, 4, November
- [2] Vivian, W. Y. , “Cost Effectiveness of using Low Cost Housing Technologies in Construction.” 1877–7058 © 2011 Published by Elsevier Ltd.doi:10.1016/j.proeng, July, 2011.
- [3] Prakash, T.M., Dr.Naresh kumar, B.G., Dr. Karisiddappa. , “Strength and Elastic Properties of Aerated Concrete Blocks (ACBs).” International Journal of Chemical, Environmental & Biological Sciences (IJCEBS) Volume 1, Issue 2 (2013) ISSN 2320 –4087 (Online), 2013.
- [4] Hebel, M.C., “Using modern methods of construction to build homes more quickly and efficiently on Autoclaved Aerated Concrete.” Technical Sheet and Installation Guide, 2009.
- [5] M.S. Shetty, Concrete Technology, 1982, S. Chand & Company Ltd, New Delhi, Edition 2005, Ch 12, page 504-607.
- [6] V.Varun Kumar, EXPERIMENTAL STUDY ON BEHAVIOUR OF BIOLOGICAL PLASTICIZER IN CONCRETE, International Journal of Scientific & Engineering Research, Volume 7, Issue 4, April-2016, ISSN 2229-5518.
- [7] IS:383:1970, Specification for coarse and fine aggregate from natural sources for concrete, second revision.
- [8] IS:3812(Part 1):2003, Pulverized fuel ash-specification, for use as pozzolana in cement, cement mortar and concrete, second revision
- [9] FunsoFalade, EfeIkponmwosa, Bright Ukponu, The Potential of Laterite as Fine Aggregate in Foamed Concrete Production, Civil and Environmental Research ISSN 2224-5790 (Paper) ISSN 2225-0514 (Online)Vol.3, No.10, 2013
- [10] Ashish S. Moon, Dr. Valsson Varghese , S. S. Waghmare, Foam Concrete as A Green Building Material, INTERNATIONAL JOURNAL FOR RESEARCH IN EMERGING SCIENCE AND TECHNOLOGY, VOLUME-2, ISSUE-9, SEP-2015.
- [11] IS 2185,PART 3 1984,specification for concrete masonry units, Autoclaved cellular(aerated) Concrete blocks.
- [12] Memon N.A., Sumadi S.R., Ramli M., Ferrocement encased lightweight aerated concrete: a novel approach to produce sandwich composite, Materials Letters, 61(19–20): 4035–4038, 2007.
- [13] Andolsun S., A study on material properties of autoclaved aerated concrete and its complementary wall elements: their compatibility in contemporary and historical wall sections, M.S. Thesis [online], Ankara, Turkey, Middle East Technical University, 2006.