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Conventional Burnt Clay Bricks Vs AAC Blocks in Construction Projects: A Comparative Study

Anindita Bhattacharjya
Department of Civil Engineering, Assam Engineering College, Guwahati

Abstract: AAC blocks and red clay bricks are two of the more majorly used blocks used in buildings all over the world. Both the block categories have a definite set of pros and cons. A comparative analysis of them is essential to understand and determine which of the two is a superior product, both technically and economically. Experimentation was done on samples of both blocks. Although, some defective set of samples didn't provide the expected results, it did provide an insight in the technicalities associated with the blocks. It further allowed a comparison between the observed data and the expected data, highlighting how defects within the blocks could affect the properties. Further, some tests were analysed by studying available reports, thesis, articles prepared by various research workers working on the behaviour and properties of AAC blocks and red clay bricks. The overall study proved that AAC blocks, though weaker in compressive strength are much superior in most other properties than the red clay bricks.
Keywords: AAC block, burnt clay brick, rate analysis

I. INTRODUCTION

Technology has always come up with solutions to our problems. In the field of construction, we have seen the emergence of new products with better properties each passing year. In this study, two of the popular building blocks used in the construction industry viz; Autoclaves Aerated Concrete (AAC) Blocks and burnt clay bricks were analysed. Though the more conventional clay bricks have been used successfully to build structures for a long time now, efforts were made to create a block with better properties, which performed well in areas the red bricks faltered in. AAC blocks are a result of these efforts. Samples of both brick varieties are collected for the present study and a detailed comparison was made between the two samples. Several properties were tested and few were analysed on the basis of previously created reports and data collected by research workers. The results obtained in the present study clearly indicate the technical superiority of AAC blocks over conventional red clay bricks. Traditional clay bricks have been in use for construction over a long period of time. Experimental studies and tests done on both AAC blocks and clay bricks showcased the dominating advantages of AAC block over burnt clay bricks which shall be discussed further. But due to high cost and complex manufacturing process, AAC blocks have been less popular by the general mass. In the present study, tests have been done on AAC blocks as well as burnt clay bricks. The results make a clear difference between the two building materials. Quality of the materials are established by the manufacturing materials composition and procedures.

II. AIMS & OBJECTIVES

The objectives of this study are

1) To study and analyse the performance of AAC masonry in building wall systems
2) To make a comparative study between AAC blocks and traditional burnt clay bricks
3) To prepare a rate analysis for AAC blocks and red clay bricks for the same volume of work and make a comparison between them

III. METHODS OF INVESTIGATION

A. Review of Literature

For all the tests and experiments that couldn't be conducted for various reasons, study was done on pre-existing reports, papers, websites that dealt with the tests or were in any way connected to them. Several research papers dealing with the required topics were collected and analysed to understand the procedures followed and ultimate results obtained out of them. This helped gain an insight on the experiments that couldn't be performed due to absence of equipment or proper laboratory facilities under close proximity.

B. Fire Resistance For Clay Brick

The extent of fire resistance provided by a clay masonry wall is a function of the wall's mass or thickness. This well-established fact is based on the results of many fire resistance tests conducted on walls of solid and hollow clay units. During the ASTM E119 fire test, the fire resistance period of clay masonry walls is usually established by the temperature rise on the unexposed side of the wall specimen. Few masonry walls have failed due to loading or thermal shock of the hose stream (Technical Notes on Brick Construction: Fire Resistance of Brick Masonry, 2008).

Heat transmission theory states that when a wall made of a given material is exposed to a heat source that maintains a constant temperature at the surface of the exposed side and the unexposed side is protected against heat loss, the unexposed side will attain a given temperature rise inversely proportional to the square of the wall's thickness(Technical Notes on Brick Construction: Fire Resistance of Brick Masonry, 2008). In the standard fire test, the time required to attain a given temperature rise on the unexposed side will be different than when the temperature on the exposed side remains constant. This is because the fire in the standard fire test increases the temperature at the exposed surface of the wall as the test proceeds. Based on fire test data collected from many fire tests, the following formula has been derived to express the fire resistance period of a wall based on its thickness: $R = (cV)^n$----------Eq. 1 where: R = fire resistance period, hr

c = coefficient depending on the material, design of the wall, and the units of measurement of R and V

V = volume of solid material per unit area of wall surface, and n = exponent depending on the rate of increase of temperature at the exposed face of the wall

For walls of a given material and design, an increase of 50 percent in volume of solid material per unit area of wall surface results in a 100 percent increase in the fire resistance period. This relationship results in a value of 1.7 for n. The lower value for n compared with 2 for the theoretical condition should be anticipated since a rising temperature at the exposed surface will shorten the fire resistance period of a wall. For a wall composed of layers of multiple materials, the fire resistance period may be expressed as follows:

$$R = (c_1V_1 + c_2V_2 + c_3V_3)^n$$

$$= (R11/n + R21/n + R31/n)n$$

C. Fire Resistance for AAC block

To test fire resistance in AAC Block samples, 50 mm cubes samples were tested at six different temperatures by using an electrical furnace. After fire resistance tests, compressive strength test was done to detect effects of fire on strength properties of AAC samples(Abdullah Keyvani, 2014). After 30 minutes heating procedure at a temperature of 100□C, no changes were observed on the appearance of AAC blocks and also no reduction in weight and compressive strength were detected. After another 30 minutes, with a temperature of 300□C, no changes were noticed on the appearance of AAC blocks. However, there was a slight reduction in the weight of blocks. On the other hand, there was a 22% reduction in the average compressive strength of the blocks. In the next 30 minutes, at a temperature of 500□C, colour of AAC blocks was observed to become darker. There was another slight reduction in weight of blocks. The average compressive strength reduction of blocks after fire test was about 28% reduction. At a temperature of 700□C, colour of AAC blocks turned even darker. Significant reduction in weight of blocks was detected. The average reduction of compressive strength of blocks after fire test shows a reduction of 35 %. After the next 30 minutes, with temperature slightly less than 900□C the colour of the blocks changed from light grey to grey. In addition to reduction in weight, cracking appeared on the surfaces of blocks observed. Average compressive strength of blocks reduced to 46% compared to the controlled samples.Heating procedure under temperature of 1000□C caused the AAC blocks to turn bright white. Significant number of cracks were noticed on the surfaces of samples. This phenomenon was due to decomposition of the chemical phases of silica and lime. Weight and compressive strength of all samples started to decrease comparing to its original dry state; this indicates that AAC losses its mass and mechanical properties subjected to the elevated temperature. It has to be considered that decreasing in the mentioned properties subjected to the elevated temperatures is acceptable up to 500□C, which shows a slight reduction in AAC properties(Abdullah Keyvani, 2014).

D. Sound Resistance

Autoclaved aerated concrete AAC offers specific favorable properties in the context of sustainable development in the construction industry.

The positive acoustic properties of autoclaved aerated concrete as such can be attributed to its internal structure, however, its density is relatively low, which is why the sound insulation performance of AAC partitions can be worse than that of walls of the same thickness made of red clay bricks. Sound insulation requirements for internal and external walls differ considerably and depend on the location and intended use of the buildings and of the building interiors. Therefore, these diverse requirements must be taken into consideration in the evaluation of sound insulation performance of AAC walls.

Aerated concrete has better insulation properties to sound transmitted by air than of other solid building materials like dense concrete, clay bricks etc. under comparable conditions. The sound insulation of a solid, one leaf homogeneous wall is primarily dependent on the weight per unit area, i.e. its surface related mass. The generally accepted relationship for solid walls' sound insulation is given by

Berger's law (RILEM, 1993) as follows: $Rs = 14.5 \log(m) + 10$ dB where,

Rs =sound reduction index (dB), m = mass of the element (kg/m2), also known as surface density.

Sound absorption is a property different from sound insulation. Sound absorbing material reduces the sound reflection from a surface, while sound insulating material reduces the sound passing through. The sound absorption coefficient indicates how much of the sound is absorbed in the actual material. The absorption coefficient can be expressed as (Halliday et al., 1997)

$\alpha = Ia / Ii$ where, α = absorption coefficient,

Ia = sound intensity absorbed (W), and

Ii = incident sound intensity (W).

To study the acoustic resistance of the given bricks and blocks, a wooden box was designed with a sliding opening. The box was fully lined with acoustic resistant material (polystyrene) to avoid disturbance from external noise persistence. Two side holes were provided in the box for placing noise-level meter inside the box, so that the noise could be measured both at the source and at the receiver end. The noise meter used was SVAN 945 A. The noise level was measured at each side for 1 minute continuously and the time-average value was given by the instrument. The acoustic testing set-up is shown in figure-1.

Acoustic resistance testing was carried out by placing one brick/block at a time inside the box-at the center of the box. The sound source of 500 Hz was placed at one side of the brick and the noise level was measured at the other side. A noiselevel meter each was placed at the sound source and at the other side of the brick to record the sound levels both at the source and at the receiver ends. The soundlevels were measured in dB at the source and receiver sides. Two tests were carried out by varying the sound level at the source. One of the tests was carried out by keeping the source-sound level constant at 71 dB, and the other test was carried out at a level of 108 dB. The sound pressure in dB was converted into sound intensity (W/m2). The reduction of the sound intensity from source to receiver end was also calculated (Szudrowicz et. al, 2017).

E. Laboratory Investigation

1) Reshaping of AAC blocks

The AAC blocks used in the experiment were purchased from Deka Enterprise and Hardware situated in Khalabari, Bapujinagar, Guwahati-20.

Fig.1 Resized blocks

It's dimensions were 600mm × 250mm × 73.5mm i.e. cuboidal shaped. However, to determine the compressive strength of the blocks in the compression testing machine, they had to be reshaped into small cubes of sides equal to the length of the blocks' smallest dimension. In this case, the smallest dimension had been 7.35 cm. The cutting was done manually using a hacksaw. Eventually, 9 cubical specimens with sides 7.4 cm were obtained. The following tests were to be done on these 9 specimens in the Strength of Materials Lab (AEC)-

- Compressive strength test
- Water absorption test
- Dry density test

2) Dry Density

Density is basically the mass per unit volume of any substance. Based on requirement, the density may be expressed as dry density, bulk density or saturated density.Dry density refers to mass per unit volume when the body mass is completely dry i.e., voids contain only air. Bulk density refers to mass per unit volume in normal condition, which means that the voids may contain some liquid and some air in its pores. Saturated density refers to mass per unit volume when the body mass is fully saturated. Since the rock mass is made of solid minerals, the specific gravity of the solids is the ratio of its density and unit weight of water. Similar to the case of porosity, rocks have a wide range of density which of course depends upon the mineral constituents and the degree of compaction in addition to the depth at which it is existing. In general dry density of the rock varies from 2.6 gm/cc to 2.8gm/cc in normal cases. Although an approximate inference is drown about the strength of a rock with values of porosity and density, but this values do not give information about the nature of a bond among the mineral grain.

The relation between bulk density and dry density is given by-

$$Y_d = \frac{Y}{1+m}$$

where Y_d= dry density Y= bulk density m=moisture content of the sample

3) Compressive Strength Test

Compressive Strength to be measured may be of two types:

(i)Uniaxial or unconfined compressive strength (ii)Triaxial compressive strength.

In the experiment conducted, the uniaxial or unconfined compressive strength has been measured using a compressive testing machine.

Uniaxial or Unconfined compressive strength is the strength when a load on the body acts in one direction only. There is no load along an axis perpendicular to the loading axis. It already has been discussed that the unconfined compressive strength depends on size and length/diameter of the sample and hence the value should be obtained in-situ condition. But when laboratory samples are being tested for required values of compressive strength, the rate of loading and the end conditions of loading are the two important factors which have to be kept in mind. Less time of testing shows higher value of unconfined compressive strength. If friction between loading plate and the body is more, the specimen will fail in shear, whereas in case of a smooth contact between the loading plate and the sample, the sample fails in tension. Vertical failure cracks appear when the sample fails. Dry samples have high compressive strength and saturated samples show low values.

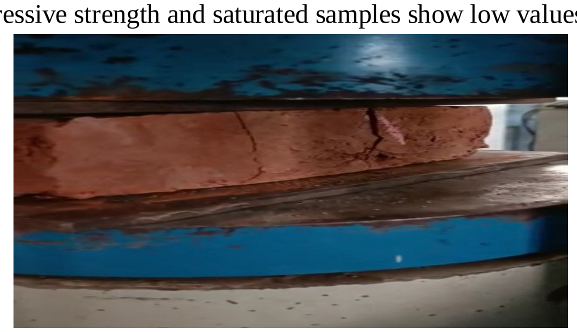

Fig.2 Figure showing Red clay brick under compression

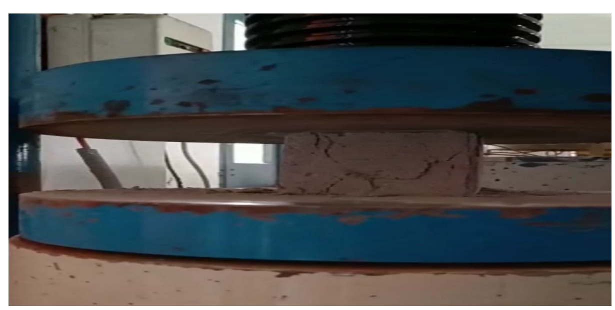

Fig.3 Figure showing AAC block under compression

The compressive strength test was done individually on 7 of the 9 blocks that had been prepared initially. Simultaneously, compressive strength test was done on 5 red clay brick specimens. To keep the surface of contact between the bricks and platens, the grooves were filled with fine aggregate. Care is taken to ensure that the loading takes place perpendicular to the surface of the block. Within a few minutes we arrive at the peak load. It can be made certain by observing the needle in the Compression Testing Machine, which stops further movement upon reaching the peak load. To calculate the compressive strength for the block, this peak load is divided by the area of the specimen surface normal to the load.

4) Water Absorption Test

The water absorption is determined by noting the loss in weight of the sample after drying it for 24 hours at a temperature ranging from 105'C to 110'C . An excess water absorption contain gives an indication that the substance is more porous, implying lesser strength.

The following procedure is followed to perform the water absorption test on different specimens:

a) The specimen is first dried in the ventilated oven at a temperature ranging from 105 degrees Celsius to 115 degrees Celsius until the specimen attains a constant mass.
b) The heated specimen is then allowed to cool at room temperature.
c) The specimen is weighed and its mass is recorded (M1).
d) Then, the specimen is immersed in water at a temperature of about 27 degrees Celsius for 24 hours.
e) The brick specimen is taken out from the water and wiped with a clean cloth to remove the traces of water that may be present.
f) The specimen thus obtained is then weighed (M2).

With 7 out of the 9 prepared blocks developing cracks inside the Compression Testing Machine, the remaining 2 blocks were kept aside for the water absorption test. Initially, the two blocks accompanied by two red clay bricks were kept inside the drying oven at the laboratory. They were kept for a period of 24 hours. After the period was over, the masses of each of the four specimens were taken and noted. Then, the same four specimens were kept submerged under water for a period of 24 hours. This was done to ensure that both the bricks and both the blocks got fully saturated with water. Again, the saturated masses were taken and noted for the four specimens. The water absorption for them was obtained using the formula below:-

$$W=\frac{M2-M1}{M1} X\ 100,$$

where M2=Mass of saturated sample
M1=Mass of dry sample
W=Water absorption

IV. RATE ANALYSIS OF RED CLAY BRICKS AND AAC BLOCKS

A. Rate Analysis Of Red Clay Brick

"Contractor's profit has not been included here"

Size of one clay brick= 20cm x 10cm x 10cm (with mortar) No. of bricks in 1 m^3 brickwork $= \frac{1}{2\ x\ 0.1\ x\ 0.1}$ = 500 *bricks*
0.

No. of bricks in 10 m^3 brickwork = 5000
Size of brick without mortar = 19cm x 9cm x 9cm
Actual Volume of 5000 bricks = 0.19 x 0.09 x 0.09 x 5000 = 7.7 m^3
Volume of mortar = 10-7.7 =2.3 m^3
A wastage of 10% is considered
Then, volume of mortar =2.3+0.23=2.53 m^3
Now, dry volume> Wet volume
A 20% increase in volume is considered
So, dry volume of mortar= 2.53 x 1.2 = 3 m^3
Weight of $1m^3$ of OPC=1440kg
Weight of 1 bag cement = 50kg

 Volume of 1 bag cement $=\frac{50}{1440}$ = $0.0347m^3$

1) For 1:2 mortar

$$\text{Volume of cement} = \frac{1}{1+2} x\ 3 = 1\text{m}^3$$

$$\text{Volume of sand} = \frac{2}{1+2} x\ 3 = 2\text{m}^3$$

2) For 1:3 mortar

$$\text{Volume of cement} = \frac{1}{1+3} x\ 3 = 0.75\text{m}^3$$

$$\text{Volume of sand} = \frac{3}{1+3} x\ 3 = 2.25\text{m}^3$$

3) For 1:4 mortar

$$\text{Volume of cement} = \frac{1}{1+4} x\ 3 = 0.6\text{m}^3$$

$$\text{Volume of sand} = \frac{4}{1+4} x\ 3 = 2.4\text{m}^3$$

4) For 1:5 mortar

$$\text{Volume of cement} = \frac{1}{1+5} x\ 3 = 0.5\text{m}^3$$

$$\text{Volume of sand} = \frac{5}{1+5} x\ 3 = 2.5\text{m}^3$$

5) For 1:6 mortar

$$\text{Volume of cement} = \frac{1}{1+6} x\ 3 = 0.43\text{m}^3 \quad \text{Volume of sand} = \frac{6}{1+6} x\ 3 = 2.58\text{m}^3$$

Table 1 Volume of cement and sand for different proportions (10m^3 brickwork)

For 10m^3 mortar		
Proportion	Cement (m^3)	Sand (m^3)
1:2	1m^3	2m3
1:3	0.75m^3	2.25m^3
1;4	0.6m^3	2.4m^3
1:5	0.5m^3	2.5m^3
1:6	0.43m^3	2.58m^3

Class-I brickwork is considered in superstructure with 1:6 cement: sand mortar.
Rate analysis for the above situation has been provided below-

Table 2 Rate analysis for class-I brickwork (1:6 mortar)

Particulars	Quantity	Rate	Cost (Rs)
1.Materials			
a)Brick	5000	Rs 12/No.	Rs 60000
b)Cement	12.96=13 bags	Rs 450/bag	Rs 5850
c)Sand	2.7m^3	Rs 1500/m^3	Rs 4050
		Material Cost	Rs 69900
2.Labour			
a)Head Mason	½	700	Rs 350
b)Mason	10	600	Rs 6000
c)Mazdoor	7	500	Rs 3500
d)Coolie	10	400	Rs 4000
e)Bhisti	2	350	Rs 700
		Labour cost	Rs 14550
3.Scaffolding	1% of (Material+Labour)	Lumpsum	Rs 844.5=845
4.Sundries, T&P	1/4th of scaffolding	Lumpsum	Rs 250
		Total	Rs 85544.5

Water charge (1.5%) = Rs 1283.16
Overhead and profit (10%)= Rs 8554.45
Overall Cost = Rs (85544.4 + 1283.16 +8554.45)
= Rs 95382.01

B. Rate analysis of AAC blocks

"Contractor's profit has not been included here"
AAC Blocks of size 600 x 200 x 150 are considered
Volume of 1 AAC block = 0.015 m^3
Assuming 10mm thickness of mortar = $\frac{1}{61 \, x \, 0.21 \, x \, 0.16}$ 0. 610 x 210 x 160 No. of block in 1 m^3 == 48.8 = 49 *blocks*

No. of blocks in 10 m^3 = 49 x 10 = 490
Now, actual volume of 490 blocks = 0.6 x 0.2 x 0.15 x 490 = 8.82 m^3
□Volume of wet mortar =10-8.82= 1.18 m^3
A wastage of 10% is considered
Then, Volume of wet mortar =1.18+0.118 =1.298 m^3
20% increase in volume for dry mortar is assumed,
Volume of dry mortar = 1.298 x 1.2 =1.557 m^3
Volume of 1 bag cement = 0.0347 m^3

1) For 1:2 mortar

Volume of cement = $\frac{1}{1+2} x\ 1.557 = 0.519m^3$

Volume of sand = $\frac{2}{1+2} x\ 1.557 = 1.038m^3$

2) For 1:3 mortar

Volume of cement = $\frac{1}{1+3} x\ 1.557 = 0.389m^3$

Volume of sand = $\frac{3}{1+3} x\ 1.557 = 1.167m^3$

3) For 1:4 mortar

Volume of cement = $\frac{1}{1+4} x\ 1.557 = 0.311m^3$

Volume of sand = $\frac{4}{1+4} x\ 1.557 = 1.245m^3$

4) For 1:5 mortar

Volume of cement = $\frac{1}{1+5} x\ 1.557 = 0.259m^3$

Volume of sand = $\frac{5}{1+5} x\ 1.557 = 1.29m^3$

5) For 1:6 mortar

Volume of cement = $\frac{1}{1+6} x\ 1.557 = 0.22m^3$

Volume of sand = $\frac{6}{1+6} x\ 1.557 = 1.334m^3$

Table 3 Volume of cement and sand for different proportions (10m^3 masonry)

For 10m^3 mortar		
Proportion	Cement (m^3)	Sand (m^3)
1:2	0.519m^3	1.038m^3
1:3	0.389m^3	1.167m^3
1;4	0.311m^3	1.245m^3
1:5	0.259m^3	1.29m^3
1:6	0.22m^3	1.334m^3

AAC blockwork is considered in superstructure with 1:6 cement: sand mortar.

Table 4 Rate analysis for AAC blockwork (1:6 mortar)

Particulars	Quantity	Rate	Cost (Rs)
1.Materials			
a)Brick	490	Rs 48/No.	Rs 23520
b)Cement	6.34=7 bags	Rs 450/bag	Rs 3150
c)Sand	1.334m^3	Rs 1500/m^3	Rs 2001
		Material Cost	Rs 28671
2.Labour			
a)Head Mason	1	700	Rs 700
b)Mason	2	600	Rs 1200
c)Bhisti	1	350	Rs 350
		Labour cost	Rs 2250
3.Scaffolding	1% of (Material+Labour)	Lumpsum	Rs 309.21=310
4.Sundries, T&P	1/4th of scaffolding	Lumpsum	Rs 77.5
		Total	Rs 31,308.5

Water charge (1.5%) = Rs 469.6
Overhead and profit (10%)= Rs 3130.85
Overall Cost = Rs (31308.5+469.6+3130.85)
= Rs 34908.95

V. OBSERVATIONS

From the rate analysis it can observed that the overall cost of AAC Block masonry is significantly less than the overall cost of Brick masonry for the same volume of work (10m^3). This reduces the overall construction cost of any building that is built by AAC blocks. Thus it is a huge cost cutter. A point to emphasize on here is that the total money spent on labourers for AAC block masonry in practical situations is less than that spent on brick masonry for the same volume of work. This is basically due to the lesser working hours required in AAC block masonry due to its lightweight and easy to handle nature.

VI. RESULTS

A. Compressive Strength Test

1) AAC blocks

Dimension of cubical specimen, s=73.5mm
Cros-sectional area of cubical specimen= $s^2 = 73.5^2 = 5402.25mm^2$

Table 5 Showing compressive strength trials on AAC blocks

SL No.	Weight (g)	Cross-sectional area (mm^2)	Force at cracking (KN)	Compressive Strength

				(N/m²)
1.	253	5402.25	8	1.48
2.	249	5402.25	8	1.48
3.	269	5402.25	8	1.48
4.	254	5402.25	7	1.29
5.	284	5402.25	7	1.48
6.	263	5402.25	10	1.85
7.	248	5402.25	8	1.48

Mean compressive strength= 1.505 N/mm

2) Red clay bricks

Table 6 Showing compressive strength trials on Red Clay Bricks

SL No.	Weight (g)	Length (cm)	Breadth (cm)	Crosssectional Area (mm^2)	Force at cracking (KN)	Compressive Strength (N/mm^2)
1.	3386	23.5	11.9	27965	465	17.05
2.	3509	23.1	11.8	27258	450	16.09
3.	3372	23.1	11.5	26565	490	18.44
4.	3096	22.9	11.5	26335	480	18.22
5.	3366	22.9	11.7	26793	440	16.42

Mean compressive strength= $\frac{17.05+16.09+18.44+18.22+16.42}{5}$ = 17.24 N/mm^2

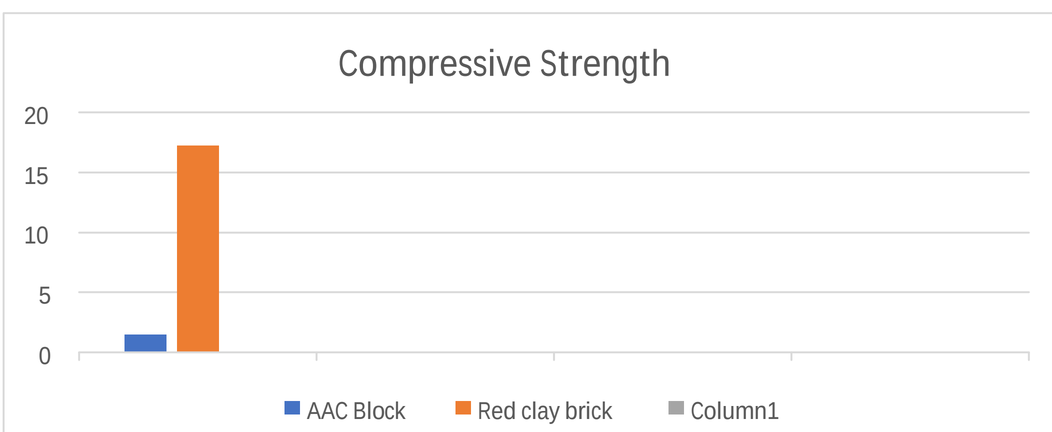

Fig.4 Chart showing comparison in thecompressive strength

3) Water Absorption Test

Table 7 Showing water absorption trials on AAC blocks

SL No.	Saturated surface dry weight (g)	Ovendry weight (g)	Water absorption
1.	358	235	52.34%
2.	384	258	48.83%

Mean water-absorption= $\frac{52.34+48.83}{2}$ = 50.585 % (which is unacceptable)

Table 8 Showing water absorption trials on Red clay bricks

SL No.	Saturated surface dry weight (g)	Oven-dry weight (g)	Water absorption
1.	3900	3279	18.9%
2.	3969	3408	16.46%

Mean water-absorption= $\frac{18.9+16.46}{2}$ = 17.68 %

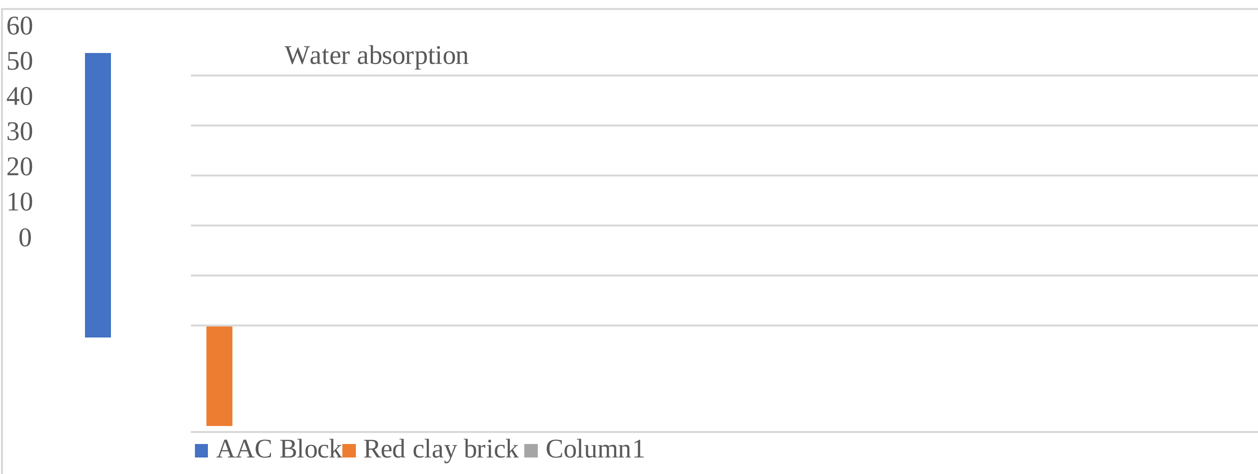

Fig.5 Chart showing comparison in water absorption

Table 9 Showing dry density of AAC blocks

SL No.	Dry weight (g)	Volume (cm^3)	Dry density (g/cm^3)
1.	235	397	0.591
2.	258	397	0.65

Mean dry density= = 0.6205 g/cm

Table 10 Showing dry density of Red clay bricks

SL No.	Dry weight (g)	Volume (cm^3)	Dry density

			(g/cm^3)
1.	3279	1982.7	1.65
2.	3408	1948.8	1.75

Mean dry density= = 1.75 g/cm

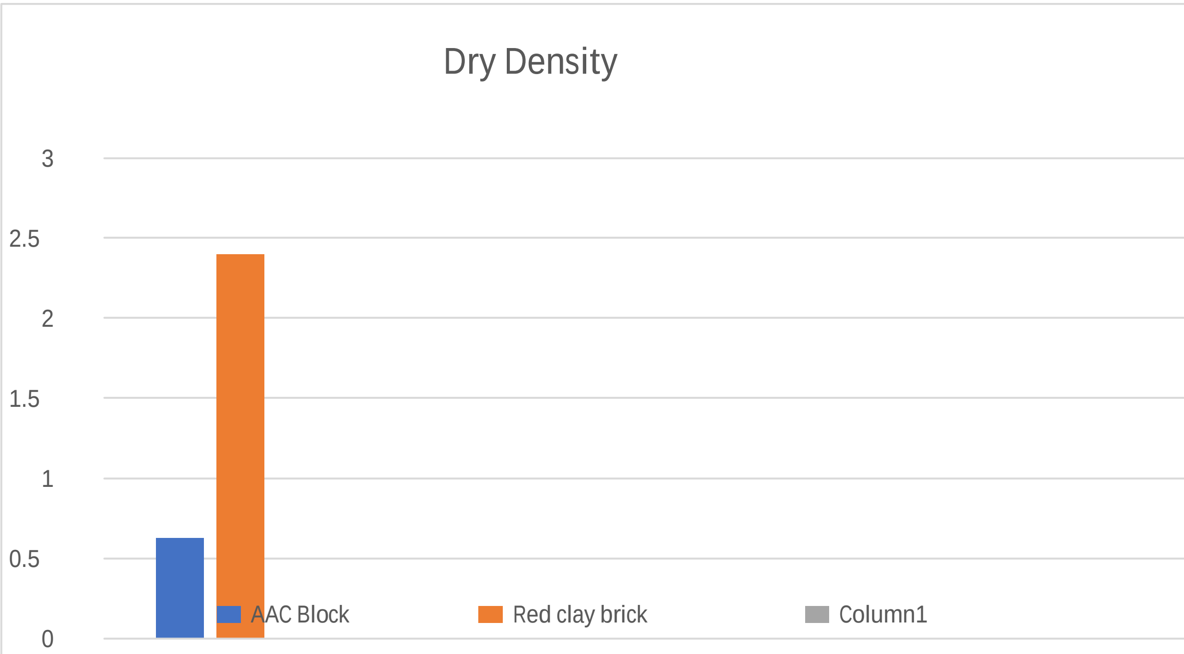

Fig 6 Chart showing comparison in dry density

Table 11 Calculated values of all properties

Property	AAC Block	Red Clay Brick
Compressive Strength	1.505N/mm^2	17.24 N/mm^2
Water Absorption	50.585 %	17.68 %
Dry Density	0.6205 g/cm^3	1.75 g/cm^3
Cost of 10m^3 masonry	Rs 34908.95	Rs 95382.01

Table 12 Fire Resistance ratings of clay masonry walls

Material Type	Minimum Equivalent Thickness for Fire Resistance (mm)			
	1 hr	2 hr	3 hr	4 hr
Solid bricks of clay or shale	69	97	124	152
Hollow brick or tile of clay or shale, unfilled	58	86	109	127
Hollow brick or tile of clay or shale, grouted	76	112	140	168

VII. COMPARATIVE ANALYSIS BETWEEN RED CLAY BRICKS AND AAC BLOCKS

As per the study conducted on both block varieties, the AAC blocks were in most ways superior to the red clay bricks. Be it the sound insulation, fire resistance, water absorption, dry density or the total cost, AAC blocks prove to be much better than the clay bricks.

Of all the properties analysed, compressive strength is the only aspect where red clay bricks had the upper hand. The results show that the mean calculated compressive strength of AAC Blocks is 1.505 N/mm^2, while that of red clay bricks is 17.24 N/mm^2. Although the blocks tests had some defects and the minimum compressive strength of AAC blocks is 3-4.5 N/mm^2, the results do abide by the fact that compressive strength of red clay bricks is much greater than that of AAC blocks. The low self-weight of the AAC blocks is the first advantage it has over red bricks. This is evident from the dry density tests done in the lab. The results clearly indicate that the AAC blocks have a significantly low dry density than the red clay bricks.When used in structure, these blocks play a huge role in reducing the total dead weight of the structure. This also allows the masons and other labourers to work at a much faster pace, thereby reducing the total time required to complete the construction. In case of water absorption too, AAC blocks prove to be superior. The tests conducted show water absorption in red bricks to be 17.68% and that in AAC blocks to be 50.585%. However, due to the AAC blocks being defective, the result obtained is significantly high and hence should not be used for practical construction purpose. Moreover, a proper (non-defective) sample of AAC block would show a water absorption of around 10% i.e. much less than that of red clay bricks, which gives them an advantage over the latter. A detailed study of existing literature on AAC blocks and red clay bricks was required to analysed them on the basis of fire resistance and sound insulation. It was found yet again that AAC blocks were superior in both aspects. While an AAC fire wall just 150 mm thick can resist at least for six hours, a clay brick wall of similar thickness (152mm), the resistance provided wouldn't be more than four hours. The additional two hours would come in real handy to protect or preserve some extra lives or property in the situation of a fire. Again, sound insulation reports prove that AAC blocks offer sound insulation of about 42 dB which is significantly greater than what the red clay bricks offer, thus making them a superior choice over red clay bricks.

VIII. CONCLUSION

A detailed comparative analysis between AAC blocks and red clay bricks was of immense importance. Common people have spent their lives watching their homes being built with the red bricks. This has developed a certain amount of trust on the performance of these bricks in their minds. They however are quite sceptical about the other variety of building block which too is being rapidly used now viz. AAC block.

Generally, compressive strength and water absorption of AAC Blocks need to be around 3-4.5 N/mm^2 and less than 10% respectively. However, in the experiments conducted, the compressive strength and water absorption of the tested sample was found to be 1.505 N/mm^2 and 50.585 respectively. This indicates that the sample tested had been defective in nature. Had more blocks of different brands been tested for the same properties, a more accurate value could have been reached. Also, it could have helped draw a comparison between the properties of AAC blocks belonging to different brands. The aspect of construction closest to the heart of the common man is the money that would be spent on it. Care is always taken by people that a construction job in their homes is done well at the most optimum charges. With AAC block masonry, charges (for both labour and material) get reduced significantly, thus making them a more economical and client friendly building material. The compressive strength of them being lower is one of the very few properties which could be worked upon and enhanced in the future. The regulatory authority of the government supervising the quality control of building materials have a pivotal role in regulating the manufacture of sub standard materials thereby improving the quality and durability of the products available in the market for construction purposes. It is only a matter of them before common people realize the value that AAC blocks provide. One could then notice most buildings in their neighbourhood being built of AAC. Needless to say, AAC blocks could very well, be the future of construction.

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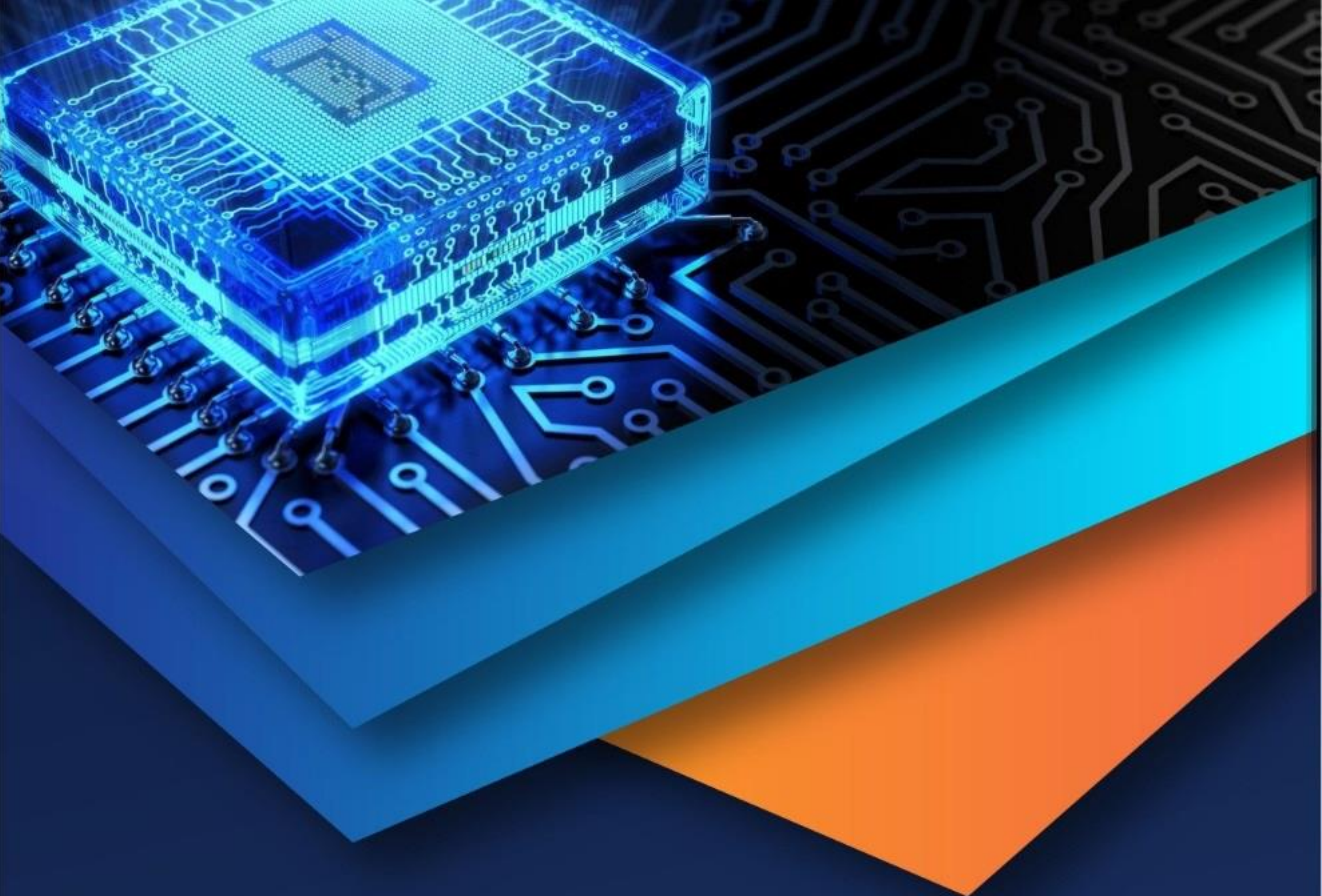

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