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## A Comparative Study of AAC Block & Clay Brick under Gravity Loading For Buildings

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**ABSTRACT:** - Brick is the most commonly used building material in construction. AAC blocks are new construction material which is very light in weight. Compare to same size of (200mm x 100mm x 100mm, its 3 times lighter than traditional brick (clay brick)); it means it covers more area in same weight as clay brick gives in one bricks. In this paper; attempt has been made to replace the clay brick with light weight AAC blocks. The usage of AAC block reduces the cost of construction up-to 25% as reduction of dead load of 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 55%.

**KEY WORDS:** - Autoclaved aerated concrete (AAC), Light weight, Clay bricks, Cost reduction, Difference.

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### I. INTRODUCTION

The walls are a very important part of any structure since they are the ones which distinguishes the structure from the environment; providing insulation, privacy etc. And the brickwork is what makes the wall and one very important for us now is AAC blocks which we are comparing with regular Burnt Clay Bricks. The raw materials used for preparation of AAC blocks are fly ash, cement, gypsum, lime and aluminum powder; fly ash being very important for manufacturing process. Raw materials are mixed to a slurry form and poured into moulds, then allowed to rise. The aluminum powder reacts with calcium silicate hydrate to liberate hydrogen gas and later during autoclaving process the hydrogen gas escapes from matrix leaving behind many pores. These pores are also responsible for reduced weight of AAC blocks. This provides AAC blocks with better insulation. Apart from insulation, AAC blocks reduce the cost of a building to a very high extent since it reduces the wall load and hence reducing the overall loading of the structure. The main reason behind analyzing AAC is its very crucial role for decreased cost of construction with better efficiency. Till now it has not been a very popular constructional material since many people aren't aware of this amazing constructional material. The reduced costing is attained from any things like reduced reinforcement requirement, reduced sizes of structural members, reduced bricks required and indirect factors like reduced plastering width and less mortar required for brickwork.

### II. MATERIALS AND METHOD

The materials we have used are AAC blocks and burnt clay bricks and compared them throughout in and out. We have structurally designed a building, each time using AAC blocks and clay bricks separately. After the complete analysis, we witnessed various differences.

Firstly we drafted our planning in Staad Pro and then designed beams and columns for clay bricks. Then we similarly designed beams and columns for AAC blocks over StaadPro. After designing the members, reactions were found out and compared for both of the building materials. After the reactions found out, grouping was done for separate columns and beams depending upon the reactions that came at particular nodes. The footings were also grouped and there areas were found out too which later was compared for both bricks. A detailed estimate was made for the structural members and compared in both the bricks.

Slab, footings and staircase were manually designed in which the only member where we see the difference is the footings. The reason behind designing them manually is not accurate results over Staad Pro, generally over reinforced sections. Reinforcement and estimate of the footings was calculated where we noticed the difference between the two.

After comparison of all the members, overall costing in brickwork was also found out for both the bricks. Finally, every difference in structural members and brickwork etc is very clearly mentioned.

## LITERATURE REVIEW

From most of literature it was observed that

AAC blocks are relatively new material in construction industry. Despite of drastic growth in manufacturing of AAC blocks, market share of AAC blocks is very small as compared to red clay bricks. As on the basis of soil consumption of AAC blocks, it has zero soil consumption. Primary raw material for AAC blocks is fly ash. Fly ash is industrial waste generated by coal based thermal power plants. Clay bricks of one sq ft carpet area consume 25.5 kg of top soil. AAC block consumes 1 kg of coal whereas Clay bricks consume 8 kg of coal. AAC Blocks with CO<sub>2</sub> emission is 2.2 kg per sq ft area as compared to clay. Brick which emits 17.6 kg per sq ft of CO<sub>2</sub>. Hence it environment friendly too. In market AAC Blocks are available in sizes 600/625 X 200/240 X 100-300 mm whereas clay bricks are available in sizes 225 X 100 X 65 mm. Experiment shows that compressive strength of AAC is 3-4 N/m<sup>2</sup> whereas clay brick have 2.5-3 N/m<sup>2</sup>. This means high compressive strength of AAC blocks over Clay Bricks. On the basis of density of both the blocks, AAC have 500-700 Kg/m<sup>3</sup> whereas clay bricks have 1800 kg/m<sup>3</sup> which indicates light weight nature of AAC blocks over clay bricks. Due to this, dead weight of the structure is reduced to far more extent and hence the structural members passes on reduced sizes and reduced reinforcement; this indicates economy attained by the structure constructed using AAC Blocks. AAC Blocks is also for better material providing 30% more insulation and sealing from the environment.

All the above points are taken from the various research papers published.

### Experimental studies:-

- **Size of different brick taken in analysis:-**

Clay brick = 200mm x 100mm x 100mm

AAC block = 300mm x 200mm x 100mm

- **Density of different brick:-**

Density of clay brick = 5.5 KN/m<sup>3</sup>

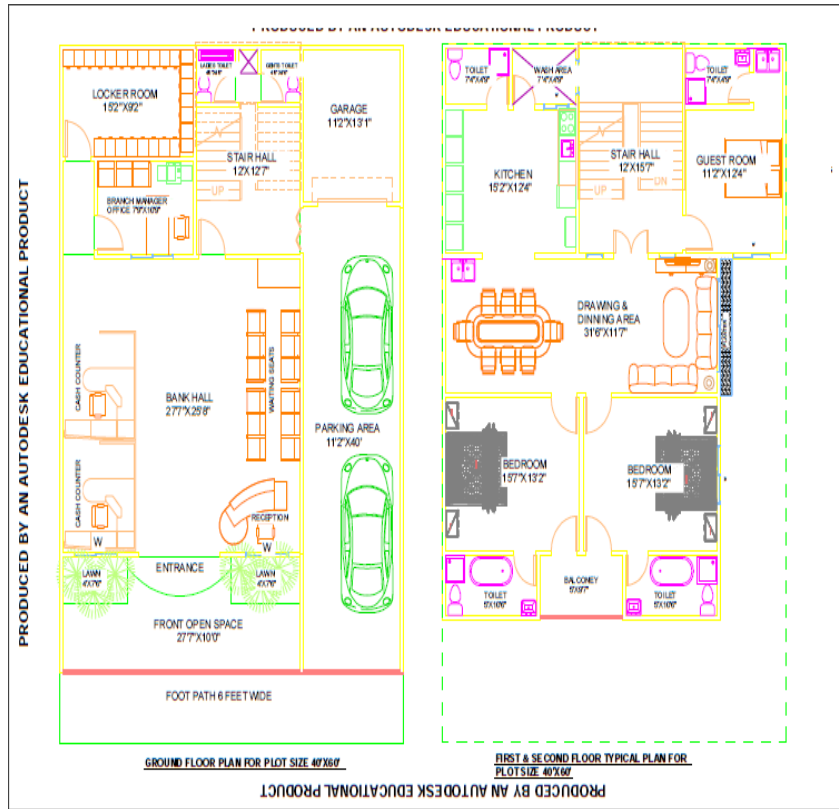
Density of AAC block = 19 KN/m<sup>3</sup>

- **Load efficiency analysis**

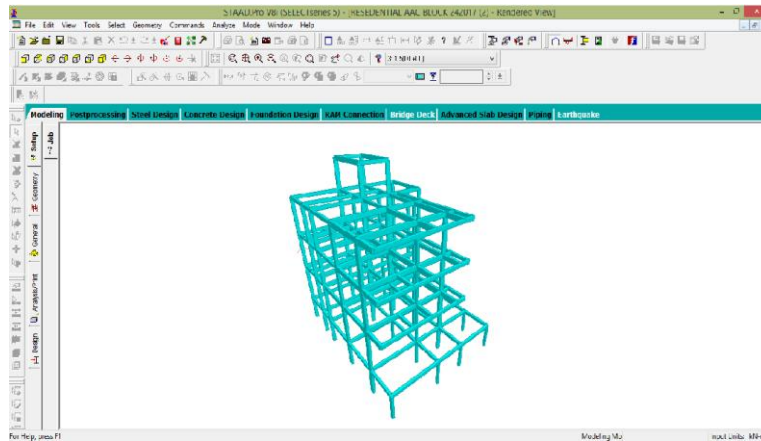
A) **Assumptions**

The buildings have the following criteria:

- 1) Building is 3 storey (G+2) high and floor area 16m x 12m.
- 2) Building is framed concrete structure.
- 3) Building is residential and has layout as shown
- 4) The building is design for static loading or say for gravity load i.e. Dead load & Live load



On comparing the loadings of each building blocks with clay brick loading.



**RESULT:** - The results which we have found out from our analysis are:-

**Total reaction comparison:-**

Type	Clay bricks	AAC blocks
Total reaction	12514KN	9471KN

**Area of footing required**

Type	Clay bricks	AAC blocks
Area of footing	61.18m <sup>2</sup>	46.30m <sup>2</sup>

### Reinforcement comparison of Columns

Type	Clay bricks	AAC blocks
Column reinforcement	5473kg	4650kg

### Reinforcement comparison of Beams

Type	Clay bricks	AAC blocks
Beam reinforcement	4300 kg	3350kg

### Reinforcement comparison of Footings

Type	Clay bricks	AAC blocks
Footing reinforcement	325.13 kg	131.45 kg

### Brick work comparison

Type	Clay bricks	AAC blocks
No. Of bricks/blocks	29100 bricks per floor	9750 blocks per floor

### CONCLUSION

Through our analysis and comparison, we have managed to find many clear conclusions. Total savings while choosing AAC blocks are as follows:-

- Total reaction of AAC block is 24% less as compare to clay bricks.
- In brick work, AAC blocks are used 66.5% less as compare to clay bricks than 66.5%.
- Area of footing there is 24.3% of saving n footings there is 24.3% savings while using AAC blocks over clay bricks.
- For reinforcement in footings, there is a saving of 45.5 % for AAC blocks as compare TO CLAY BRICKS In column reinforcement there is 15% of steel saving in AAC blocks as compared to clay bricks.
- There is 15 % and 17% of savings in columns and beams respectively for AAC blocks over clay bricks.

This was the only savings which we could clearly see but while using AAC blocks over clay bricks, more savings would be seen in per unit rate of AAC blocks and very less use of plastering and mortar while brickwork, as compared to Clay Bricks . AAC blocks proved to be the best constructional material amidst other bricks having just a much selected few disadvantages.

### REFERENCES

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- 2). we preferred IS code provision 456-2000 For statically data and manipulation
- 3). we have preferred B.N DUTTA for estimation and costing