

Cost wise Comparison on Gap fillers in Masonry Walls.

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Abstract - The aim of this paper is to address the Low cost housing. In the Load Bearing Structures Masonry walls plays a prevalent role in load transfer mechanism, and hence a conspicuous importance is to be provided in selecting the materials for it. Our work mainly involves in the comparison of Masonry Walls with conventional gap fillers, with Rat-Trap-Bond and masonry walls with AAC (Autoclaved aerated concrete) Blocks. Our drudgery had clinched off that Rat -Trap bond had provided better Ecofriendly and Economy based Gap-Filler in Masonry walls was to that would would satisfy upcoming generation dreams in the best way.

Key Words: Rat-Trap-Bond, Autoclaved aerated concrete blocks, Normal bonds.

1.INTRODUCTION

Mr.Laurie Baker is invented the Rat Trap Bond for an cost -effective construction. A "Rat-Trap-Bond" is a type of brick masonry. The size of a brick is 230 x 110 x 75mm. The shiner and rowlock are visible on the face of masonry. The wall with an internal cavity bridges by the rowlock. By making cavity in the bonding brick, cement can be saved considerably .This method also comes under Green building technologies and appropriate option against conventional wall masonry. The Rat-Trap-Bond construction is a modular type of masonry construction.

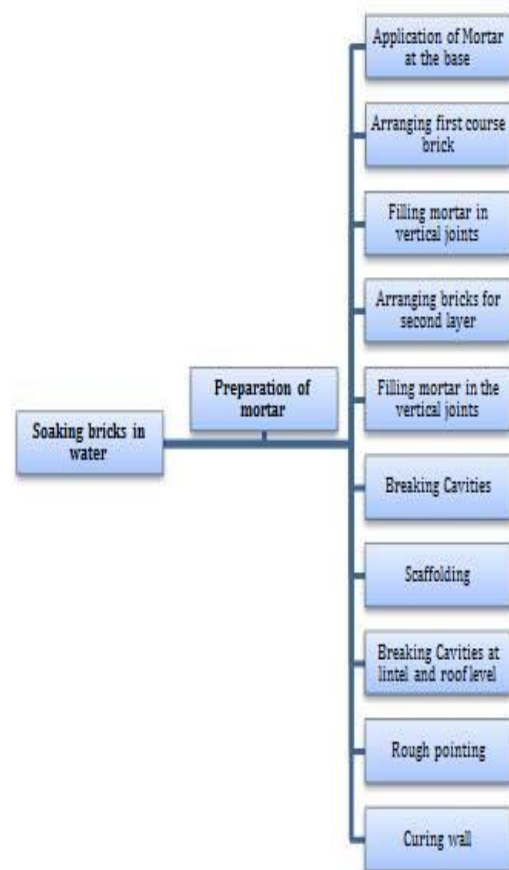
The autoclaved aerated concrete blocks are made from Fly ash, Cement, Lime, and Water and an aerating agent. AAC blocks are lightweight and fairly energy efficient. It was an Eco-friendly building material. The AAC blocks are Fire resisting material. It was also non-allergic and hence maintains the quality of air within a building without changing any properties over a time. By using AAC blocks, we can reduce our construction cost about nearly 30% over time.

2. Rat-Trap Bond Masonry

It was one of the types of masonry techniques. Here the bricks are used in a way which creates a cavity within the wall while maintaining the normal wall thickness. In English bond or Flemish bond, the bricks were laid flat whereas in Rat-trap bond masonry, the bond was laid on shiner and in

rowlock manner. The main advantage of Rat-Trap bond is to reduce the number of bricks and the mortar used here was similar to the normal methods. In addition, this cavity makes the wall more thermally efficient. It also reduces the embodied energy of brick masonry by saving number of bricks and the C.M which was mainly suitable in one-brick wall requirement.

2.1 Construction Details of Rat-Trap Bond masonry



3. Autoclaved aerated block constructions

Autoclaved aerated concrete is a precast product which was prepared by Fly ash, Cement, Lime, and an expansion agent like aluminum powder. The AAC blocks are more economical in society. The aerated concrete is available in blocks and in panels. This masonry is used for both load and

non-load bearing structure. AAC blocks are fire proofing, thermal efficiency, it reduces noise pollution and improves in indoor air quality. The AAC structures were well-suited to withstand fires, Earthquakes, and other Natural disasters. Do not use abbreviations in the title or heads unless they are unavoidable.

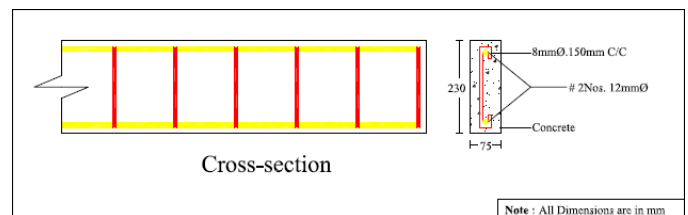
Table 1 - Comparison of AAC blocks vs Clay bricks

| Parameter | AAC Block | Clay Brick |
|--|--|--|
| Size | 400 x 215 x 100 mm | 230 x 115 x 75mm |
| Precision in Size | Variation 1.5mm (+/-) | Variation 5mm (+/-) |
| Compressive Strength | 30 - 40 kg/cm ² | 25 - 30 kg/cm ² |
| Dry Density | 551 - 650 kg/m ³ (over dry) | 1950 kg/m ³ |
| Wet Density | Approx. 800 - 850 kg | Approx. 2400 kg |
| Wastage | Up to 5% | Up to 20% |
| Burning | Done in Autoclaves with High Pressure steam: ready in 12 hours | Done in Clay Kilns |
| Fire Resistance | Up to 6 Hours for 215mm thickness | 2 hours |
| Sound Reduction (DB) | 45 for 215 mm thick wall | 50 for 230mm thk wall |
| Thermal Conductivity | Approx. 0.16 - 0.25 | Approx. 0.81 |
| Surface Quality (Fungus problems) | None; Smoot clean finish with no fungus | Fungus and salinity problems on the surface [Reh] |
| Adaptation to various surface Finishes | Smoother surface results in better coating application | Inconsistent surface |
| Mortar Consumption | 0.018 per m ³ with 1:6 / 0.5 Bag of Cement | 0.1 per m ³ with 1:6 / 1.35 bag of Cement |
| Construction Time | Reduced by upto 50% compared to clay bricks | Double AAC blocks |
| Energy Saving | 32% (Approx.) Air-Condition Load both Heating and Cooling will come down | No Saving |
| Cost Benefit Factor | Dead Load Reduce Structural cost | No Saving |
| Contribution to Carpet Area | 2 - 3 % | No Saving |
| Chemical Composition | Fly Ash used min. 50% which reacts with [Lime & Cement] to form AAC which is an inert material | Soil which contains inorganic impurities like sulphates are used and that results in efflorescence |

4. Designing a Masonry Buildings

A Masonry buildings are designed by using IS 4326:1993. The band shall be made of reinforced concrete of grade which should not be leaner than M15 or reinforced brick work in cement mortar which should not leaner than 1:3. The bands can be of full wide of the wall and not less than 75mm in depth and reinforced with steel. The band was provided at the Lintel and Roof/Floor. By providing a band on lintel and roof, it acts as an Earthquake resisting building.

4.1 Reinforcement and Bending Detail in R.C Band



5. Calculating Bricks/Blocks required for 3m x 3m room

5.1 Calculating Normal Brick required for 3m x 3m room :

Brick dimension
= 20 x 10 x 10 cm.

For placing a First layer all around the building
= 112 No. of Bricks.

For placing a Second layer all around the building
= 112 No. of Bricks.

For constructing a 3m height of Brick Masonry
= 28 layers.

No. of Brick required for constructing a 3m x 3m room
= **3200 No. of bricks required**

5.2 Calculating a Brick required for Rat-Trap Bond for 3m x 3m room :

Brick dimension
= 0.23 x 0.11 x 0.075 m.

For placing a First layer all around the building
= 120 No. of Bricks.

For placing a second layer all around the building
= 120 No. of Bricks.

For constructing a 3m height of Brick Masonry
= 26 layers.

No. of bricks required for constructing a 3m x 3m room
= **3120 No. of bricks required**

5.3 Calculating a AAC Blocks required for constructing a 3m x 3m room :

Block dimension
= 440 x 215 x 100 mm.

For placing a First layer all around the building
= 24 No. of Blocks.

For placing a Second layer all around the building
= 24 No. of Blocks.

For constructing a 3m height of wall
= 13 layers.

No. of Blocks required for constructing a 3m x 3m room
= **312 No. of Blocks required**

Table 2 - Comparison of English bond, Rat-Trap Bond and a AAC Block

| Type of Wall Construction | English Bond (Normal Construction) | Rat-Trap Bond | AAC Block Construction |
|--|------------------------------------|-----------------------|------------------------|
| Brick/Block dimension | 0.2 x 0.1 x 0.1 m | 0.23 x 0.11 x 0.075 m | 0.44 x 0.215 x 0.100 m |
| Mortar thickness | 0.0075 m | 0.0075 m | 0.0075 m |
| Total Bricks/Blocks need for constructing a 3m x 3m room | 3200 No. of Bricks | 3120 No. of Bricks | 312 No. of Blocks |
| Mortar need for constructing | 1.253 m ³ | 0.831 m ³ | 0.313 m ³ |
| Cost of 1 Brick/Blocks | Rs.6/- | Rs.6/- | Rs.70/- |
| Total cost of Bricks/Blocks need for construction | Rs.19200/- | Rs.18720/- | Rs.21840/- |

6. CONCLUSIONS

For the human beings, Housing is the most basic need. This research paper will help to construct a building in low cost. The techniques of construction can be easily adopted for the construction of all types of buildings. Rat-trap bond is an innovational technique for efficient brick work system with many advantages over the conventional brick work system. By using Rat-trap bond for the construction purposes, it was able to reduce the huge usage of materials. Rat-Trap bond construction has a very good future scope for its development as a commercial product. We can partially replace instead of normal construction techniques by using a

Rat-Trap bond and by using an AAC block construction techniques.

REFERENCES

- [1] <https://doi.org/10.5281/zenodo.345438>
- [2] Low cost housing manual (pdf)
- [3] International Journal of Applied Engineering Research ISSN 0973-4562 Volume 11, Number 1 (2016) pp 484-491
- [4] http://en.wikipedia.org/wiki/Embodied_energy
- [5] <http://www.bmtpc.org/topics.aspx?mid=356&Mid1=365> — Rat trap Bond Walling Technique Details
- [6] <http://sepindia.org/ihd-sep/ceeef-technologies/rat-trap-bond-a-masonry-technique/>
- [7] <http://www.ruralhousingnetwork.in/technical/rat-trap-bond/Introduction>
- [8] <http://www.slideshare.net/ChitraVishwanath/rat-trap-bond-masonry>
- [9] Construction-of-an-Ecofriendly-Building-using-Green-Building-Approach: A research Paper by Ashish Kumar Parashar, Rinku Parashar, International Journal of Scientific & Engineering Research, Volume 3, Issue 6, June -2012
- [10] http://www.gharexpert.com/a/ashishbatra/1658/Ratrap-Bond_0.aspx
- [11] https://www.researchgate.net/figure/Figure-IV-Rat-Trap-Bond-DISADVANTAGES-1-Not-a-good-sound-insulator-2-Excavation-of_fig4_281273136
- [12] <https://www.slideshare.net/ssconmat/10-advantages-of-using-aac-blocks-for-building-your-dream-home-49924748>
- [13] The Masterbuilder | July 2016 | www.masterbuilder.co.in
- [14] <http://www.magicreteaac.com>
- [15] Autoclaved Aerated Concrete as a Green Building Material, Stefan Schnitzler ,October 2006
- [16] http://extension.ucdavis.edu/unit/green_building_and_sustainability/pdf/resources/auto_aerated_concrete.pdf
- [17] IS 4326 : 1993 – Earthquake resistance design and construction of buildings – code of practice