Modular Fly ash Bricks-
An opportunity to economize Building Construction.

Compiled by: Er. Tarak Mamalatdarna, Er. S K Patel and Er. D A Patel.

Abstract

House is a basic need of a Human being. A pucca house is a need of a civilized society. There is huge gap in demand and supply of pucca house. In our country we still follow the age old practice of using Burnt clay bricks as walling material in House construction. It has been observed that use of new materials like Hollow concrete blocks, RCC wall units has not been well accepted by in our country. The use of Fly ash –A waste from Coal based thermal power plants for Brick making with well developed new technologies and Machineries. Constant increase in the basic inputs in building construction warranted an economic method and materials to minimize the cost of Construction. In this paper an effort have been made to study and analyze the cost economy environ friendliness of "Using On site manufactured Fly ash –line-sand bricks and Conventional Burnt clay brick.

Introduction:-

Increasing demand for pucca house and fast urbanization in last two decades lead to high demand of Burnt Clay bricks- most widely used and accepted walling material In building construction across the country. The manufacturing of burnt clay bricks has its own known disadvantages like lack of consistence quality, Finish, lack of skilled workmen for moulding and backing, erosion of top soil, Green house effect due to release of gases during burning of clay brick. With increase thrust from government for providing pucca house to BPL families and increasing pucca house construction in rural areas and constantly increasing fossil fuel rates increases the cost of burnt clay bricks as well as its transportation cost.

Housing has been identified as an industry responsible for maximum environmental degradation. Due to use of non renewable scarce resources are consumed in basic building construction materials like Cement, Burnt clay bricks, Steel and timber. Environmental protection have brought to fore the need for using environmentally friendly material in construction.

The principle source of energy in our country is coal, the burning of pulverized coal to produce energy for generation of electricity in modern thermal power plants results in huge quantity of Fly ash generation. The problem of disposal of fly ash is becoming unmanageable day by day. Hence methods/ technologies that ensure its effective utilization therefore is required to be implemented.
Lots of work has been done by various research institutions for developing technologies and machineries for successfully manufacturing of Brick from Fly ash-lime-sand mixture.

Bureau of Indian Standard, keeping in view the advantages of modular co-ordination, has specified the dimensions of standard bricks in 100 mm module as basis for all dimensional standardisation with regards to building components. This is also in conformity with the decision of the Government of India to adopt metric system in the country. It will not be out of way to mention that the metric system was in force since 1956 but in building construction industry it has not been followed till now even in departments of Govt. of India. Rapid building activity, to be on rational lines needs a certain degree of uniformity in constructional material and standardisation with regards to quality and dimensions. Government of India through BIS has specified modular size of the brick for general use.

Modular brick is a standard brick with dimensions in 100 mm modules i.e., 190 mm x 90 mm x 90 mm or 190 mm x 90 mm x 40 mm. IS 1077: 1992 (Reaffirmed 1997) for common Burnt Clay Bricks specifications (Fifth revision) covers various aspects of this bricks.

Now with the availability of Small hydraulic press Brick moulding machine and improved Pan-mixtures makes it possible to manufacture Fly ash-lime-sand Brick on site of construction at a very economical cost and also gives flexibility in size of brick. With extensive use of machine moulding technology, it is possible to make bricks of very high strength (up to class 35). However, brick construction industry does not generally require bricks higher than class 20.

Advantages of modular brick

- Advantage of the modular bricks have been covered in the forward of IS 1077: 1992 on common Burnt Clay Building Brick specifications. A comparison of 10 m2 of wall with hand made FPS bricks, vis-à-vis hand

made modular is given at Appendix A. Considering the same conversion norms for energy and emissions as for this Appendix the profile of yearly energy saving and reduction in green house gases emissions which can be achieved by use of modular bricks in construction at ‘Delhi National Capital Region' and on ‘All India’ basis can be made and the same in given in Appendix B. Perusal of these comparisons show the use of Modular bricks results in:

- **Economy in cost of brick masonry:**

  Considering 10 m2 of un-plastered wall, it is seen that the wall with modular bricks is 17% cheaper than the wall constructed with FPS bricks. This, when translated in terms of cost would imply that a 10 m2 wall with class 7.5 modular

- **Less Consumption of mortar:**

  Mortar saving work out to approximately 27% in case of brickwork by the modular brick rather that the FPS bricks.

- **Reduction in dead weight of the structure:**

  Considering the weight of the FPS brick (3.2 kgs.) and modular brick (2.5 kgs), use of modular bricks will result in reduction of dead weight of the structure by approx. 22% with consequent impact of generating saving in steel and cement consumption and foundation design in load bearing structure. In framed structures, the safety factor would be enhanced due to less weight on the foundation.

- **Gives more carpet area:**

  Municipal by-laws state that the width of load bearing walls to be 200 mm thick. Modular bricks give load-bearing wall (200 mm thick) as per municipal byelaws against 230 mm wall thickness given by FPS bricks. Thus, with modular bricks an additional 2% carpet /floor area is achieved.

Table of cost comparison for 10 Sq.m wall.

Sr. No.	Item of comparison	Conventional	Modular	Remarks
1	Un plastered thickness	230 mm	190 mm	
2	Volume of masonry	2.30 m3	1.90 m3	
3	No. of bricks required	1050 no.	950 no.	Without wastage
4	Cement in mortar	147.23 kg (2.95 bags)	110.96 kg. (2.22 bags)	
5	Sand and labour cost			Considered same
6	Cost of brick per no.	Rs. 1.65	Rs. 1.25	
7	Cost of bricks	Rs. 1730.50	Rs. 1187.50	Saving @31%
8	Cost of cement at Rs. 150 per bag.	Rs. 442.50	Rs. 333.00	Saving @25%
9	Weight of masonry wall	4420 kg.	3650 kg.	Reduction in Wt.@ 17%

Brief details of materials specifications and its consumption, Cost of Plant and machineries

Raw material

Fly ash 70% to 80%
Sand 12% to 18%
Lime 8% to 10%

Raw materials Characteristics

Fly ash Fineness Module 0.05 to 0.08 mm
Sand Fineness Module 1 to 1.5 mm
Lime Fineness Module 800 microns

Brick Characteristics

Bulk density	15850 to 1600 kg/Cu.m
Water absorption	15 to 18%
Compressive strength	80 to 120 Kg/ Sq.Cm
Brick size	190 x 90 x 90 mm
Weight	2.30 kg.

Cost and Material consumption for 10000 Nos. of Bricks.

Fly ash	75%	17.25 Mt
Sand	17%	4.00 Mt
Lime	8%	1.90 Mt

Cost of Project

Pan Mixture and Hydraulic	
Press station for brick moulding	Rs. 6,25,000=00
Moulds and pallets etc.	Rs. 75,000=00
	==========
	Rs. 7,00,000=00

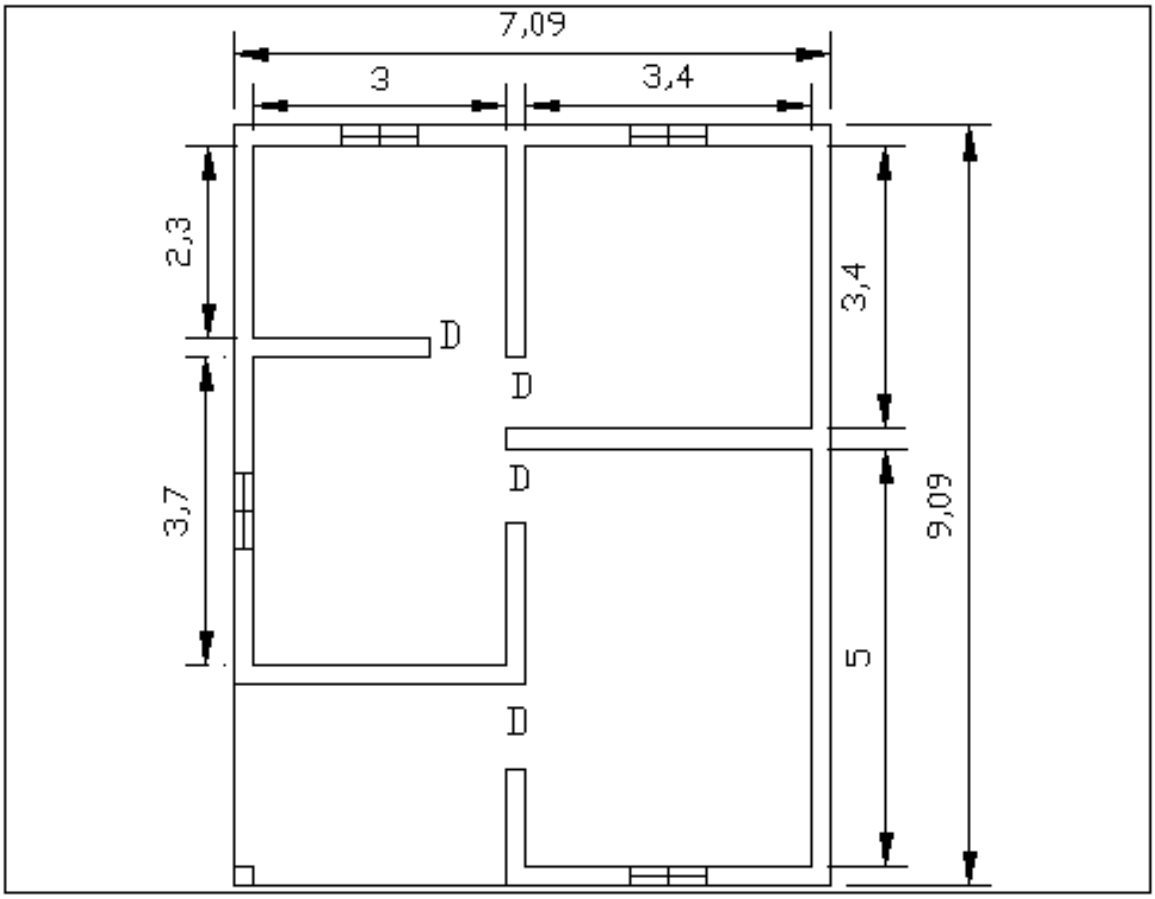
Plant parameters

Plant capacity	600 to 700 bricks per hour
Moulding pressure	Min. 200 Kg/Sq.cm
No of shifts	2
Daily Production	10000 Nos.

Model Building Plan selected for the comparison of Cost Economics

The typical building plan of two Room kitchen Unit is considered for working out the comparison of cost economics, The model Building plan chosen is a typical urban LIG/MIG units. At present only comparison of Cost saving in super structure of Ground floor has been analyzed.

A typical Building plan Of Ground floor LIG /MIG Blocks in urban area



Comparision of On site manufactured Fly Ash Lime Sand Bricks for Case study

	Conventional bricks	Modular Bricks
Built up area at floor level	61.44 Sq.m	61.44 Sq.m
Wall area	10.13 Sq.m	8.44 Sq.m
Carpet area	54.31 Sq.m	56.00 Sq.m
Increase in carpet area	------	1.69 Sq.m
Increase in percentage		2%
Total Brick work in Gr floor	27.90 Cu.M	23.25 Cu.m
Saving in brick work		4.65.Cu.m
Saving in Percentage		17 %
Brick masonry rate	Rs. 1190/-Cu.m	Rs.1040/- Cu.m
Cost Of masonry	Rs. 33201/-	Rs.24180/-
Saving in Rs.	0.00	Rs. 9021/-
Saving in Percentage	----	27%

For A small housing project of 100 Units the saving will be Rs. 9,00,000/-

Advantages

Technical

1. Lesser unit weight of brick improves mason efficiency.
2. Uniform size of Flyash lime Sand Bricks requires less mortar.
3. Due to machine moulding Flatter surfaces on both side of wall results in to saving in plaster mortar quantity and results in to better finish.
4. It can be used as facing bricks.
5. Lighter than ordinary Burnt clay bricks reduces the dead load on structure.
6. More resistance to moisture and salinity.

General and environmental

With the availability of smaller hydraulic moulding machines On site manufacturing of Fly ash bricks reduces the Cost of transportation and the wastage. It results in to saving of fuel. Reduces environmental pollution and disposal cost.

Conclusion

The use of fly ash based modular size bricks produced on site at housing projects can be further economical by saving in wastage, transportation/handling, plaster of uniform and less thickness, reduction in dead weight of structure/foundation etc. Mass housing projects of residential tenement or multistoried buildings and low cost housings like Sardar Awas or Indira Awas plans of government can lead a way in use of fly ash based modular bricks.

Acknowledgements:

1. Paper on Brick from fly ash – An effective substitute for burnt clay brick by Shri J. Sengupta, Chief – Building Materials, Building materials and Technology Promotion Council, New Delhi published in Technical volume of 18th All India Builders' Convention – 1999.
2. Paper on Modular Bricks: Cost Effective and Environment Friendly Walling Material by Shri R. S. Chaudhari and Brig (Retd) A S Madan published in Technical volume of 21st All India Builders' Convention – 2005.
