

COMPARATIVE ANALYSIS OF THE ECOFRIENDLY MATERIAL AND COST ESTIMATION OF THE PROJECT

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ABSTRACT: This study has been done as part of project for developing a comparison system of building materials, which could assist housing association in selecting the best available product for the best accessible item to reduce the natural effect of building. Buildings are the single biggest energy consumer in the Greater Noida and the NCR Region. In this case study, Study on the eco-friendly material used in Greater Noida construction site, analyse the quantity and the quality of the materials and quantify the cost of the eco friendly building material on the site. For this study, select the fly ash brick plant and autoclave aerated concrete (AAC) blocks plant in the Greater Noida city. Study the ingredients, quantity of materials, percentages of materials, setup of the plant and cost of the materials to make the fly ash brick and AAC blocks. This study concludes AAC block has large size and light weight as comparison to fly ash bricks. The compressive strength of the fly ash brick is more as comparison to the AAC blocks. The setup cost of the AAC block plants is more as comparison to the fly ash brick plant and also requirement of skilled labour for the AAC blocks. AAC blocks and fly ash brick uses pozzolanic materials which gives better strength, durable, environment friendly and resistance to chemical attack.

Keywords: Autoclaved Aerated Block (AAC), Fly ash, Strength, Cost

1. INTRODUCTION

Fly ash is a fine, glass-like powder recovered from gases created by coal-fired electric power generation. Flyash material is solidified while suspended in the exhaust gases and is collected by electrostatic precipitators or filter bags. Since the particles solidify while suspended in the exhaust gases, flyash particles are generally spherical in shape and range in size from 0.5 μm to 100 μm . They consist mostly of silicon dioxide (SiO_2), aluminum oxide (Al_2O_3) and iron oxide (Fe_2O_3). Fly ash concrete was first used in the U.S. in 1929 for the Hoover Dam, where engineers found that it allowed for less total cement. 180 billion tons of common burnt clay bricks are consumed annually approximately 340 billion tons of clay- about 5000 acres of top layer of soil dug out for bricks manufacture, soil erosion, emission from coal burning or fire woods which causes deforestation are the serious problems posed by brick industry. The above problems can be reduced some extent by using fly ash bricks in dwelling units.

AAC (Autoclaved Aerated Concrete) was invented in the mid-1920s by the Swedish architect and inventor Johan Axel Eriksson. AAC is one of the significant accomplishments of the twentieth century in the field of development. It is a lightweight, precast building material that at the same time gives structure, protection, and fire and shape protection. AAC Blocks is an interesting and incredible sort of building materials because of its sublime warmth, fire and sound protection. AAC block is lightweight and offers ultimate workability, plasticity and stability. The finished product is a 2.5 times lighter Block compared to conventional Bricks, while providing the similar strengths. In this paper, select the two fly ash brick plant and one AAC blocks plant located in the greater noida region. Analyse the raw materials, cost of the materials, specific material which is better and cheap for the construction, quality of the materials.

2. FLY ASH RAW MATERIALS PROPERTIES, COST OF THE SETUP

2.1 Characteristics of Fly ash

The physical and chemical properties of Fly Ash are tabulated below as given in Table 1.

Table 1: Physical Properties of Fly Ash

Physical Properties	
Specific Gravity	2.56 to 2.66 gm/cc
Bulk Density	1.13 gm/cc
Fineness	365 to 460 M2/Kg
Type of Fly ash	Class C

2.2 Fixed Capital

Fixed capital such as building and land lease rent are as given in Table 2.

Table 2: Description of land and buildings

Sr No.	Description	Amount (INR)
1	Land Lease Hold	75,000
2	Building	1,00,000
3	Overhead water tank	30,000
Total (A)		2,05,000

2.3 Machinery and Equipment

Table 3: Description of machinery and equipments

Sr No.	Description	QTY	Rate (INR)	Amount (INR)
1.	Automatic fly ash brick making machine electric operated with all accessories and fitting with 18 HP Motor	1	11,00,000	
2.	Pan mixture 500kg capacity with 7.5 HP Motor	1	3,00,000	
3.	Belt conveyor with necessary fitting and 2HP motor	1	2,00,000	
Total				16,00,000
4.	Erecting and electrification charges			30,000
5.	Office charges			25000
Grand Total (B)				16,55,000

2.4 Other Expenses per Month

Table 4: Description of machinery and equipments

Sr No.	Description	Amount (INR)
1	Telephone	1000
2	Repairs and maintenance	5000
3	Travelling and Transportation	2500
4.	Insurance	1500
5	Postage and stationery	2000
6	POL	7000
Grand Total (C)		19,000

Total cost = A+ B+ C = 2, 05,000+16, 55,000+19,000 = 18, 79,000

2.5 Studies on Fly Ash Brick Plant in Greater Noida

These fly ash brick plant are placed in greater noida. One plant is nearby sector 17 B and another one is sector 22D. Brick size is 230x110x75mm which make in the plant.

1. S K ENTERPRISES

This plant is located at sector 17B in greater noida. The rate of the plants as tabulated in table 3.5 for 100 no. of bricks. Cost of the hundred numbers of bricks for making is 288INR but the market cost with transportation to the site is 377INR. There is a good benefit in this work.

Table 5: Equipments and Material Cost

Contents	Quantity	Rate (INR)	Total Cost (INR)
Machine setup	1	16,00,000	16,00,000
Fly Ash	260 kg	0.350	91
Hydrated Lime	45 kg	1.8	81
POP	15 kg	3.2	48
Diesel	23 L		23
Labour cost	45 INR		45
Total			288

Market Cost = 377 INR

2. Mahadev Fly ash Brick

This plant is located at sector 22D in greater noida. The rate of the plants as tabulated in table 3.6 for 100 no. of bricks. Cost of the hundred numbers of bricks for making is 293INR but the market cost with transportation to the site is 377INR

Table 6: Equipments and Material Cost

Contents	Quantity	Rate (INR)	Total Cost (INR)
Machine setup	1	16,00,000	16,00,000
Fly Ash	250 kg	0.370	92.5
Hydrated Lime	45 kg	1.9	85.5
POP	15 kg	3.2	48
Diesel	21 L		21
Labour cost	46 INR		46
Total			293

Market Cost = 388 INR



Figure 1: Machine setup and Fly Ash bricks

3. AUTOCLAVED AERATED CONCRETE (AAC) BLOCK RAW MATERIALS PROPERTIES, COST OF THE SETUP

3.1 Size of AAC Bricks

These are the sizes of the blocks which makes in the plant as given in Table 7. Availability of AAC blocks different size as per the construction work.

Table 7: Size of the Different Sizes of AAC Blocks

Size (in Inches)	Size (in mm)	No of bricks / M ³	Weight (Kg)	Market Price
24.6 * 9.44 * 4	625 x 240 x 100	67	9.8	46-49
24.6 * 9.44 * 6	625 x 240 x 150	46	14.36	65-68
24.6 * 9.44 * 8	625 x 240 x 200	34	19.59	88-91

3.2 Ingredients of AAC Blocks

Main ingredients and addition of the percentages of the materials are as shown in given Table 8.

Table 8: Ingredients Description of AAC Blocks

Ingredients Description	Percentage Mix (%)
Fly Ash	65-70
Cement	15-18
Lime	8-9
Gypsum	1-2
Aluminum Powder	0.03-0.08
Mould Oil	As per mould size (litre)
Water	48-52

3.3 Case Study of AAC Block Plant: Karnava Builders Phase-1 B, Industrial Area, Surajpur, Greater Noida.

3.3.1 Plant specifications

This plant of area has 5 acres in the surajpur region and the silo capacity of 150 tons as tabulated in Table 9. In the silo, mix the fly ash slurry and uses Gypsum and cement mixes.

Table 9: Plant Description

1.	Silo capacity	150 Ton
2.	Plant area	5 Acre

3.3.2 Quantity and cost of the materials

AAC blocks have some technical specifications which are tabulated in Table no 10. The quantity of all the materials has been accountable in the unit of Tons. Description of land, other contingency and cost of all things are tabulated in Table 11

Table 10: Quantity and Cost of the Materials for 1 Ton Material

Sr. No.	Ingredients	Density x Addition of Materials	Total Quantity	Rate/Materia (INR/KG)	Total Cost (INR)
1.	Fly ash	2300 x 67	1541 kg	2.5	3852.5
2.	Cement	2300 x 18	414 kg	6.5	916.5
3.	Lime	2300 x 8	184 kg	6.2	1140.8

4.	Gypsum	2300 x 1	230	2	460
5.	Al. Powder	2300 x .08	1.84	220	338.8
6.	Mould oil			40/Litre	40
Total Cost of Materials (a)					6748.6

Table 11: Description of land and other contingency

Sr. No.	Description	Cost/Month
1.	Man Power	15-18 Lakh
2.	Electricity Bill	4-5 Lakh
3.	Diesel	3-4 Lakh
4.	Lease Rate of Land	5 Lakh
5.	Plant Setup	16 Crore
Total Cost (b)		16 crore 30 lakh

Total Cost: (a) + (b) = 6748.6 + 16 crore 30 lakh = 16 crore 30 lakh , six thousand seven hundred forty eight (16,30, 06748.60)

3.3.3 Technical specifications

Table 12: Technical Specifications of acc blocks

Specifications	AAC Blocks
Strength	>4 N/mm ² (150mm size cubes)
Shape & Size	Rectangular, 625 x 240 x 100
Water Absorption	22
Breakage / Wastage	0.5-0.8%
Mortar Consumption	Very Less
Plaster Thickness	8-12mm
Nos. of Bricks for per Cubic Meter	67
Density	550-650 kg/m ³
Weight	9.8kg
Mould Size	3.9 cbm before cutting
Cake size	3.65 cbm after cutting
Fly ash Slurry density	1.48-1.52



Figure 2: Plant view and AAC blocks

4. CONCLUSION

AAC block and fly ash bricks are a long proven material. AAC block is used in a wide range of commercial, industrial and residential application and has been in use in India at the time of 1972. In this project, select the two fly ash brick plant and one AAC blocks plant located in the greater noida region. Analyse the cost of the materials, specific material which is better and cheap for the construction, quality of the materials and how much these plants uses waste compositions and finally the cost of the AAC blocks and fly ash brick.

As per the study the following conclusions are as shown below:

- AAC block plants and fly ash brick plants uses waste like fly ash which is beneficial to consumption of waste materials and environment also.
- AAC block has large size and light weight as comparison to fly ash bricks.
- The compressive strength of the fly ash brick is more as comparison to the AAC blocks.
- The setup cost of the AAC block plants is more as comparison to the fly ash brick plant and also requirement of skilled labour for the AAC blocks
- AAC blocks and fly ash brick uses pozzolanic materials which gives better strength, durable, environment friendly and resistance to chemical attack.
- AAC blocks and fly ash brick walls needs less requirement of mortar paste on the outer surface of the walls for plastering work.
- AAC blocks uses only for partition walls (not load bearing) but fly ash brick can be used as load bearing walls in the structures.

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