FORCE Engineering

"TRUST BUILDER"

AUTOCLAVED AERATED CONCRETE (AAC) BLOCKS PLANT

(Capacity: 50m3)

REG. OFFICE:-

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INTRODUCTION:

AAC (Autoclaved Aerated Concrete) was invented in the mid-1920s by the Swedish architect and inventor Johan Axel Eriksson. AAC is one of the major achievements of the 20th century in the field of construction. It is a lightweight, precast building material that simultaneously provides structure, insulation, and fire and mold resistance. AAC Blocks is a unique and excellent type of building materials due to its superb heat, fire and sound resistance. AAC block is lightweight and offers ultimate workability, flexibility and durability.

Main ingredients include fly ash, water, quicklime, cement, aluminum powder and gypsum. The block hardness is being achieved by cement strength, and instant curing mechanism by autoclaving. Gypsum acts as a long term strength gainer. The chemical reaction due to the aluminum paste provides AAC its distinct porous structure, lightness, and insulation properties, completely different compared to other lightweight concrete materials. The finished product is a 2.5 times lighter Block compared to conventional Bricks, while providing the similar strengths. The specific gravity stays around 0.6 to 0.65. This is one single most USP of the AAC blocks, because by using these blocks in structural buildings, the builder saves around 30 to 35 % of structural steel, and concrete, as these blocks reduce the dead load on the building significantly.

AAC is a long proven material. AAC block is used in a wide range of commercial, industrial and residential application and has been in use in EUROPE over 90 years, the Middle East for the past 40 years and in America and Australia for 25 years. It's an estimate that AAC now account for over 40% of all construction in UK and more than 60% of construction in Germany. In India production of AAC block started in 1972.

This unit is proposed to manufacture AAC Blocks by consuming the Fly-Ash as one of the prime raw material. Fly-Ash, a major raw material with 70% proportion in AAC Blocks, an indispensable by-product of Thermal Power Plants, is an environmental threat across the globe. Power plants are facing an ever increasing challenge of disposal of this polluting agent.

ASSUMPTIONS:

Fly ash is to be provided free of cost by power plants. Only transportation is to be arranged by project. Average distance of 100 KM (price depend on state).

Carbon Credit estimates is for reference purpose. The Project owner must handle his part of CDM project to get Carbon credits, through independent consultants. Carbon credit can be transacted on registration. The PCN preparation & presentation, the PDD preparation & presentation, host country approval and the UNFCCC Registration might take somewhat 6 months to 2 year. So it may be wise to start early.

Sale price at site is estimated at conservative Rs 3000/- per cubic meter. AAC Blocks of all sizes will be manufactured according to the market requirement, though mainly stipulated sizes as per the BIS standards. Production is estimated at 90% capacity.

ADVANTAGES:

The advantages are as follows:

1. Consumes Fly ash, which is a big problem for thermal power plants to dispose. It is environment friendly, because of no need of burning.

2. Higher strength, best thermal insulation & excellent sound absorption, vibration resistance compared to red bricks. The AAC product's lightweight and easy workability means that is very quick to install on site and transportation with lesser breakage.

3. AAC blocks made walls can be left exposed (without Plaster) and gains strength over time. It saves structural cost by 35% and recycling of breakage, rejects also.

4. AAC products are not affected by harsh climatic conditions and will not degrade under normal atmospheric conditions.

5. AAC Block does not have any toxic substances nor does it emit odors. Its production, management and disposal do not represent any health risks or damage to the environment. Its production process develops non-toxic gases.

6. AAC blocks are bigger in size then conventional bricks, resulting in lesser number of joints. Less joints result in lesser quantity of mortar required, resulting in saving of mortar.

MARKET:

Fly ash is available continuously and of satisfactory quality. Users are of the opinion that strength, durability, finish, availability, price are the important qualities in blocks.

Very high willingness is observed among traditional manufacturers regarding use of fly ash in their products. Technical assistance & increased product awareness among the public are considered important for promoting the shift in the manufacturing practices.

High preference for fly ash products is observed among those customers contacting manufacturers. Increased media coverage & favorable policies are considered key for increasing utilization of fly ash bricks & blocks.

The current prices of fly ash blocks are in the same range of cement blocks & traditional bricks. But comparatively fly ash blocks are having more strength, fire resistance, earthquake resistance, light weight, lesser breakage and saves structural cost by 40%.

Since 60% of country's electricity comes from coal based power station, the country has a huge stock of fly ash amounting to 60 million tons annually. Despite the entire efforts present scenario is not too encouraging as only 5% of country's total ash has been consumed in different sectors.

With the rise in population and increase in constructional activities considering the improvement in the standard of living the demand for building bricks is increasing day by day.

RAW MATERIALS, SOURCES AND AVAILABILITY:

Fly-Ash:

A lot has been said about this raw material in this Project Profile itself. But this Raw material is freely available in Thermal Power plants. There are no taxes on this item whatsoever. Transportation charges are only to be attended by the entrepreneur.

Lime:

Active powered lime is a requirement for giving the real aeration to the product. In phase 1 we can aim to buy the active lime directly. In phase -2 we can think of having backward integration and making a lime powering unit at site to have a more competitive advantage, we can also think of a lime burning kiln inside the factory premises.

The project financials however have not considered the costs of powering unit, and the lime kiln in this project.

Different qualities of lime are available, and depending on the raw materials, the mix design can be chosen to get the optimal quality of production.

OPC:

This Project aims to utilize OPC cement as main binder material. It will give faster strength to the bricks, besides giving improved consistent quality. It also ensures a better cost effectiveness for the same. Using OPC will be a standardized practice. The other prime advantage of using

OPC (compared to other binders) is it's easy availability locally through nationwide Retail Network of Cement Companies.

Gypsum:

Gypsum is easily available industrial product. This is available as an industrial byproduct of Fertilizer Plant. Gypsum is responsible to give long term strength to the Blocks.

Aluminum Powder:

Finely ground Aluminum powder is used in very limited quantity (less than 0.5%), so that it reacts with active lime, and silica in base material to make the aeration, and swell the product, making it very light weight product.

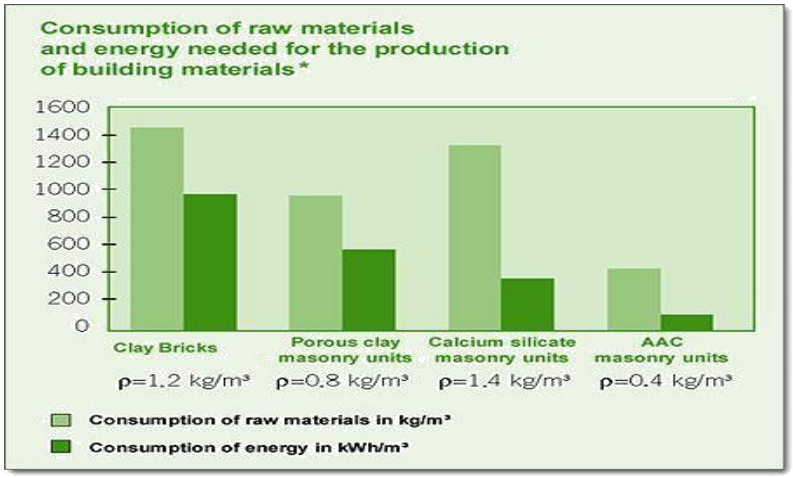
PROJECT AT A GLANCE:

Product Details : AAC lightweight Blocks
Type : Fly Ash Based or sand based
Technology Area : Infrastructure & Green-Tech
Capacity Utilization : 90%

PROCESS DETAILS:

1 mould includes 3.024 Cu.mtr. Slurry
1 Autoclave includes 12 moulds
1 process includes 1 autoclaves (process time = 10-12 hours)
Water requirement: 450 Liters per Cu.mtr.

CONSUMPTION OF RAW MATERIALS AND ENERGY NEEDED FOR PRODUCTION OF BUILDING MATERIALS:



BRIEF PRODUCTION PROCESS:

1. COAL FLY ASH:

The coal fly ash will be sent to the slurry preparing pond by wheel loader to be prepared required concentration coal fly ash slurry by add rated water, which will be pumped into slurry tank to be stored and ready to be used.

2. QUICK LIME:

The powder will be sent into the lime powder silo for storage and ready to be used by bucket elevator, after coming into the factory.

3. GYPSUM:

The gypsum in the storage shed will be added into slurry pond according to the required proportion, while preparing slurry.

4. CEMENT:

The cement will be transported into factory by tank truck and directly is pumped into cement silo to be used.

5. ALUMINUM POWDER PAST:

The purchased aluminum powder past in the bucket or bag will be stored in its storehouse, When being used, it will be lifted to second floor of the batching building, then measured and added into aluminum mixer to prepare 5% suspending liquid to be used.

6. SCRAPE AND WASTE SLURRY:

The cleaning waste water under the casting machine will be pumped to ball mill to be used as grinding water. The scrape from the cutting machine will be prepared to slurry and pumped into waste slurry tank to be used.

7. BATCHING, MIXING and CASTING:

Coal fly ash will be sent to electronic scale in the batching building by pump at the bottom slurry tank to be measured. When the slurry concentration arrives at batching requirement, the control system will turn off the pump to stop pump slurry. The measured the slurry will be directly discharged into casting mixer.

Lime and cement will be sent to electronic scale in the batching building by single screw conveyer at the bottom of their silos. When measuring arrives at the required quantity, they will be sent to casting mixer by screw conveyer.

Aluminum powder will be measured by manual, and added into aluminum mixer to be prepared suspending liquid one by one for each mould. The finished suspending liquid can be directly added into the casting mixer. The slurry temperature should be arrived at required process temperature before casting. And mould will be moved to the bottom of the casting mixer by ferry car.

8. CUTTING AND GROUPING:

After pre-curing, the green block arrive at the required strength, the crane will take it to the cutting machine section. After removing the mould, the green block will be cut according to the required size. The green block after cutting will be moved to the curing trolley with the bottom plate by crane in front of autoclave for grouping. The seven trolley for each autoclave with 14 pieces of green block.

9. AUTOCLAVED AND FINISHED PRODUCT:

The green block after grouping, will be moved into the autoclave by windlass for curing. The whole curing period is approx. 12h, pressure approx.1.2Mpa, temperature approx. 1850. After curing, the product will be pulled out of autoclave, and be sent to the store yard.

10. THE BOTTOM PLATE RETURNING, COMBINING WITH MOULD AND OILING:

After unloading, the side plate on the trolley will be lifted for returning rail by crane, and be returned to the side of the cutting machine, which will be combined with the mould and sent to mould returning line for cleaning and oiling to be reused.

TECHNICAL SPECIFICATIONS OF AAC BRICKS:

Size (in Inches)	Size (in mm)	No of bricks / m3	Weight (Kg's)	Market Price
24 * 8 * 4	600 x 200 x 100	83	8 – 9.5	41 – 44
24 * 8 * 6	600 x 200 x 150	56	9.5 – 11.5	61 – 64
24 * 8 * 8	600 x 200 x 200	42	13.5 – 15	82 – 85

PLANT CONSTRUCTION AREA:

Shed Area : 1000m2

Total Area of Production : 800m^2

Total Plant Area 0.5Acre

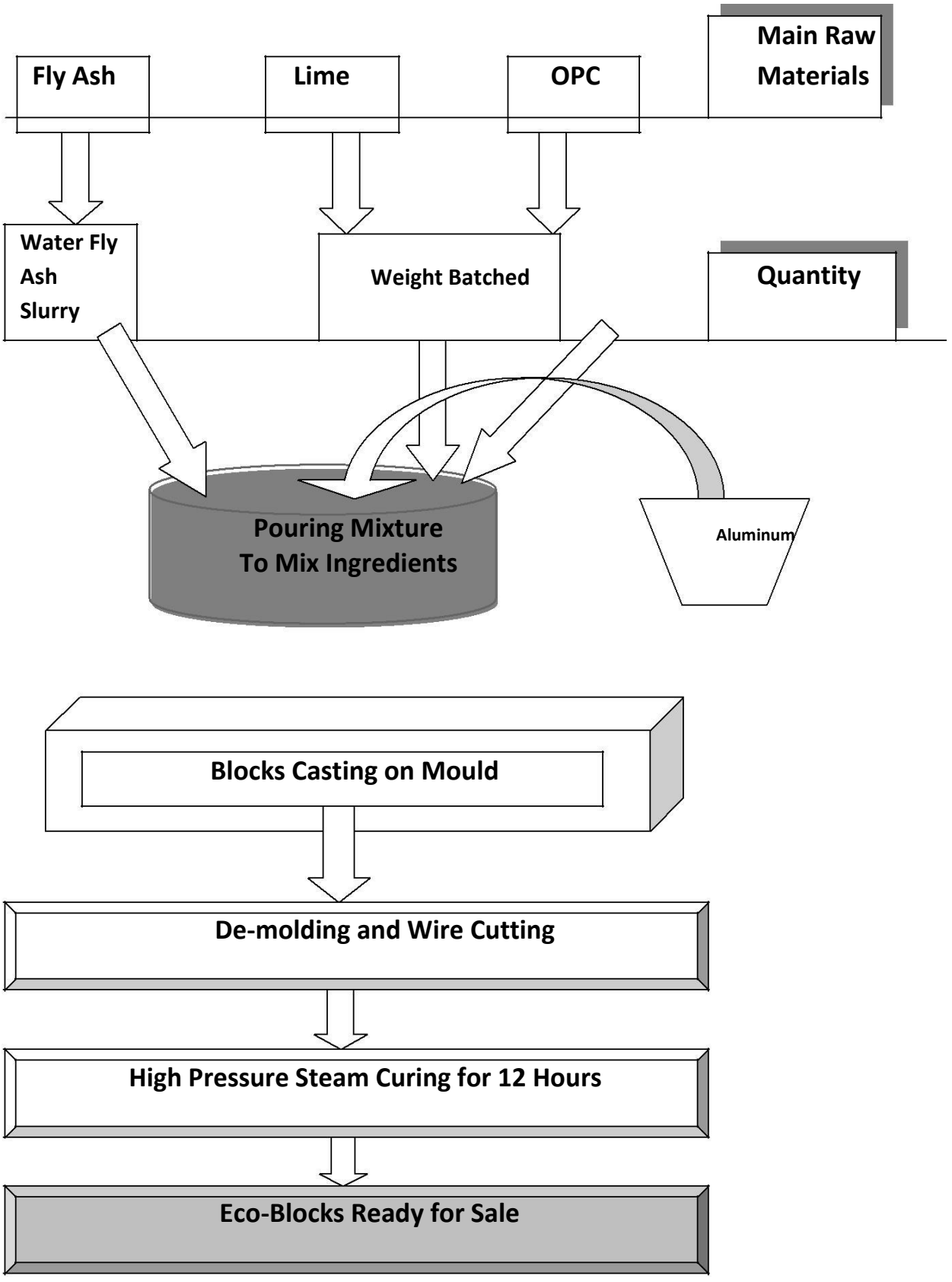
MANPOWER:

(Per Shift)

Position	**Number**
General Manager	1 Person
Production	1 Person
Technical	1 Person
Boiler Operator	1 Person
Labour	7 Person

Every shift needs 11 – 12 people; 2 shifts need 22 - 24 person.

PROCESS FLOW CHART:



PHOTOGRAPHS:

Just for technical clarity some of the photos of the real working are provided here.

RAW MATERIAL SUITABILITY:

Almost 95% of the raw materials can be made suitable for AAC line through proper mix design. Also we can have many different mix designs for the same density same strength of Blocks.

We will help you to get the Best quality blocks at optimal cost by means of designing proper Mix as per your input raw materials.

The following are basic guidelines (certainly not the final call) on the suitability of basic raw materials for AAC.

1. Fly Ash (65-70%)			
Index Item		**Grade (%)**	
		Gr - I	Gr - II
Degree of fineness	(0.045 square hole sieve left amount) ≤	30	45
	(0.080 square hole sieve left amount) ≤	15	25
Ignition loss ≤		5.0	10.0
SiO2 ≥		45-55	40
SO3 ≤		1	2
Reference: The fineness can be 0.045 or 0.080 square sieve left amount.			

2. Lime (8-25%)				
Item	**Grade**			
	Super Gr.		**1st Gr.**	**2nd Gr**
A(CaO+MgO) Quality Fraction %	≥	90	75	65
MgO Quality Fraction %	≤	2	5	8
SiO2 Quality Fraction %	≤	2	5	8
CO2 Quality Fraction %	≤	2	5	7
Digestion speed ,min	≤	5-15		
Digestion temperature , °C	≥	60-90		
Undigested residue quality fraction ,%	≤	5	10	15
Fineness (0.080 square hole sieve left amount) %	≤	10	15	20

1. Cement (6-15%)								
SiO2	Al2O3	Fe2O3	CaO	MgO	C3S	C2S	C3A	C4AF
21-23	5-7	3-5	64-48	4-5	44-59	18-30	5-12	10-18

4. Gypsum/Plaster (3-5%)		
CaSO4	>	70%
MgO	<	2%
Chloride	<	0.05%
Preferably ground residue 90µm	<	10-15%

5. Aluminum Powder (about 0.08%)			
Type and recommendation for supply depend on raw materials and mix formula			
Metal Content	Approx.	>=65%	Powder

TECHNICAL COMPARISON:

PARTICULARS	CONVENTIONAL RED BRICKS	AAC BLOCKS
Strength	30-40 Kg/cm2	35-40 Kg/cm2
Shape & Size	Non Uniform & Irregular	Uniform & Regular
Water Absorption	40 – 45 %	15 – 20 %
Breakage / Wastage	8 – 10 %	Nil – 0.5 %
Mortar Consumption	High	Less
Density	1500 – 1700 Kg/M3	550 – 650 Kg/M3
Nos. of Bricks for per Cubic Meter	592 Nos [9x4x3inch]	67 Nos.[25x9.6x4inch]
Mortar Joint Thickness	15 – 18 mm	8 – 10 mm
Plaster Thickness	15 – 20 mm	10 – 12 mm

WORKING CAPITAL CALCULATION:

No.	Particulars	Quantity (Kg)	Rate/Ton	Amount	
1	**Raw Materials/CM**			**In Rs.**	**In Rs.**
A	Fly Ash	410	500	Rs. 205	
B	Lime	90	5500	Rs. 495	
C	OPC Cement (Tanker Load)	70	6000	Rs. 420	
D	Aluminum Power	400 gram	230 kg	Rs. 92	
F	RM/CM			Rs. 1212.00	
G	Power (KWH)	9.00	6	Rs. 54.00	
H	Coal (kg)	50.00	5	Rs. 250.00	
	Other Consumables			Rs. 50.00	
I	Total			Rs. 1566.00	
J	Add Wastage @ 1%			Rs. 15.66	
K	Raw material per CM			Rs. 1581.66	Rs. 1581.66
L	**Total Raw material** (per month)	1250 M3.	Rs. 1581.66	Rs. 59,31,225.00	
2	**Staff/Month**	Nos.	Lab/Month	Total Salary/Month	
A	Total Labour	10	Rs. 90,000.00		
B	Superviser	1	Rs. 10,000.00		
C					
D	Total Labour/Month		Rs. 1,00,000.00	Rs. 1,00,000.00	Rs. 76.92
3	Insurance per month (at 0.3% per month)			Rs. 5,075.78	Rs. 1.35
4	Other expencianc month (at 1% per month)			Rs. 5000.00	Rs. 3.33
5	13% Interest			Rs. 108333	Rs. 72.33
7	**Total Expenses per Meter Cub**				**Rs. 1760.61**

PROJECT COST:

PROFITABILITY CALCULATION:

Total Earnings: (Yearly)

Sr. No	Product	Output (%)	Output (M3)	Price Per M3	Total Income
1	AAC Fly Ash Blocks	90%	15,000	Rs. 3,200	Rs. 4,80,00,000
Total (A)					**Rs. 4,80,00,000**

Total Expenses: (Yearly)

Sr. No	Product	Output (%)	Output (M3)	Cost Per M3	Total Cost
1	AAC Fly Ash Blocks	90%	15,000	Rs. 1,760.61	Rs. 2,60,32,200
Total (B)					**Rs.** 2,60,32,200
Net Profit (Earning – Expense) (A-B)					**Rs. 2,19,67,800**

REMARKS:

1. Above listed configuration is standard reference, if any modification during equipment manufacture, or adjustment during installation causing equipment list change, our side will state explanation details in written format within 3 days, whole set producing line equipment list follows one complete line configuration, final reference as per acceptance qualified practical configuration.

2. Terms of payment: 30% down payment, 50% before container loading at Jaysingpur.

3. Lead time: 4 months

4. Package uses large goods bulk packing, small goods and electric control parts have wooden box packing.

5. After-sales service and warranty: One year free service after successful installation and One year warranty.

6. During equipment installation: Buyer provide local labour, welder, electrician, supporting equipment and fulfill other local requirements and also accommodation and food of technicians.

7. In any case order cannot be cancelled.

DISCLAIMER:

1. This is for guiding prospective client, and helping them to understand the project well.
2. This can also serve a basis for Clients Chartered Account for making a DPR for them.
3. This template with a little variation can be used to get the Pollution control NOC, and other Docs.
4. The AAC project being Modular, there can be client specific needs, which may not be mentioned herein.
5. As the raw materials vary widely, so also does the mix designs we suggest. So final costing may vary.
6. The civil costs can vary depending upon the location and the client's rapport and grasp on the field.
7. The fabrication costs depend a lot on client's ability to handle the things on his own, and Steel Prices.
8. The speed of execution of project totally depends on Clients skills to coordinate with the suppliers.

COMPARISON OF SMALL AAC AND CLC PROJECT:

No.	Small AAC Plant	CLC Plant
1.	In this plant we can make AAC Blocks.	In this plant we can make CLC blocks. Quality is lower than AAC
2.	Quality specifications including strength, density are far better than CLC.	
3.	Manufacturing cost per cu. mtr. Is lower than CLC	Manufacturing cost is higher than AAC
4.	In AAC, fly ash - 70%, lime – 15%, cement – 15% is used. So, cost is down and market viability is higher.	In CLC, major use is cement. So, not viable compared to AAC. (In CLC, Fly ash – 60%, Cement – 40%, Foam – same ration of fly ash & cement)
5.	Initial investment is same as per production capacity of CLC	Initial investment is same as mini AAC
6.	Viable in both small and big city	Only viable in small towns

Thank You

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