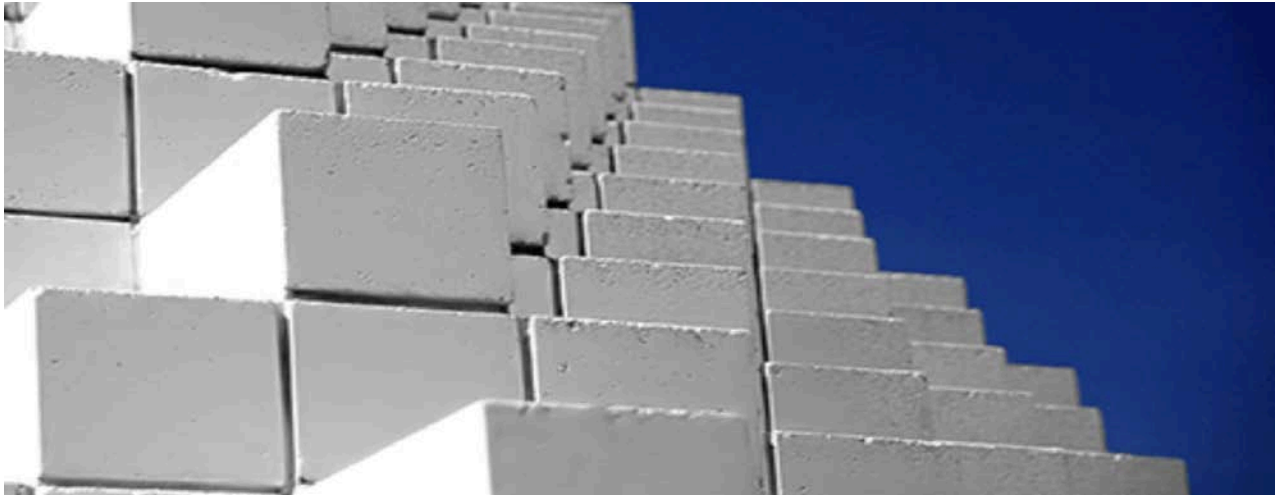


Autoclaved Aerated Concrete (AAC) Block: Conquering brick by brick



Background

Autoclaved Aerated Concrete (AAC) block is a newly-adopted green building material in India which is used as a substitute of the conventional red clay bricks in residential, commercial and industrial construction activities. Globally, AAC was originally invented in early 1923 in Sweden, and has been around for over 90 years. Although AAC was invented to overcome the shortage of timber in Sweden, the product has found global acceptance. Since then, AAC has been used extensively in Europe, Asia and USA.

AAC block is a light weight precast building material that provides both construction economy and speed. It is also an environment friendly product, as it is manufactured using 60-65% of fly ash (by weight), an unavoidable waste from coal/lignite-based thermal power plants. Due to its many desirable attributes, AAC block is gaining popularity in India now-a-days as a replacement of the traditional fired clay brick.

Industry structure and development

Indian construction industry is one of the most important sectors of the economy as it stimulates building infrastructure and creates growth opportunities for other sectors in the economy. The construction sector contributes around 8% in GDP and registered an annual growth of 4.8% during FY15. (Source: MoSPI) The building materials sector is a key constituent of the construction industry. Economic growth and demand for building materials usually moves in tandem. Driven by recent growth in infrastructure and construction activities, the building material sector has recorded considerable growth over the last few years. Moreover, India's improving economic growth, expanding population along with rapid increase in per capita income, industrialisation and urbanisation signals good growth prospects for this sector.

However, environmental conservation has also become a key focus area simultaneously, as traditional building material – fired clay brick – consumes lots of fertile land as raw material and emits huge quantity of greenhouse gases. Due to inherent drawbacks of fired clay brick manufacturing process, the emphasis on environment sustainability is growing which is thus expected to spur demand for green building materials like AAC block.

Indian conventional red clay brick sector

Clay bricks form the backbone of the Indian construction industry, which is valued at approximately Rs.9.28 lakh crore for FY15 (*Source: MoSPI*). India has the world's second largest brick manufacturing industry after China, accounting for more than 10% of the global production. Brick-making is also one of the most unorganised sectors in India which is also significantly large in size and spread. India is estimated to have over 150,000 registered/unregistered brick kilns satisfying an annual demand of over 200 billion bricks which translates into an estimated industry size of more than Rs.60,000 crore. It has also continuously grown over the years on account of a rapid increase in the demand for physical buildings and infrastructure.

Red clay brick manufacturing depends on soil as its major raw material and coal & other biomass as fuel. It is estimated that the brick industry consumes around 350 million tonnes of good quality soil and around 25 million tonnes of coal (fourth largest consumer of coal after power, steel and cement sector) along with huge quantity of biomass fuels every year. Clay brick manufacturing is a major source of environment pollution as it consumes fertile land and emits greenhouse gases (carbon dioxide – CO₂) affecting air, agriculture and vegetation.

India's red clay brick sector is characterised by traditional firing technologies, reliance on manual labour and low mechanisation rate together with the dominance of small-scale brick kilns, single raw material (clay) and lack of institutional capacity for the development of the sector. Considering the mentioned factors along with the market size and demand potential of brick in construction activities, several opportunities exist in Indian brick industry to improve resource efficiencies and promoting green building technologies such as fly ash-based AAC block.

AAC block: an emerging green building material in India

AAC block, which is also known as autoclaved cellular concrete or autoclaved lightweight concrete or aerated brick, is an eco-friendly building material used in construction activities. AAC block offers a unique combination of strength, low weight, cost-effectiveness and durability compared with a clay brick. It is a steam-cured mixture of fly ash, cement, lime and aeration agent. Other AAC products include wall panels, floor and roof panels and lintels.

Although AAC block has been in use since long globally, the AAC block is an emerging product and a growing industry in India. Currently, AAC products are manufactured in more than 40 countries and are used in more than 70 countries. As of 2014, there are more than 3,000 AAC production facilities globally with an estimated production capacity of 450 million cubic meters per annum (CMPA) (Source: www.iaacpa.org). Xella International GmbH is world's largest AAC manufacturer, while Biltech Building Elements Ltd. (rated 'CARE BBB') is India's largest AAC manufacturer. More AAC block plants are being set up across India as awareness about AAC block is growing.

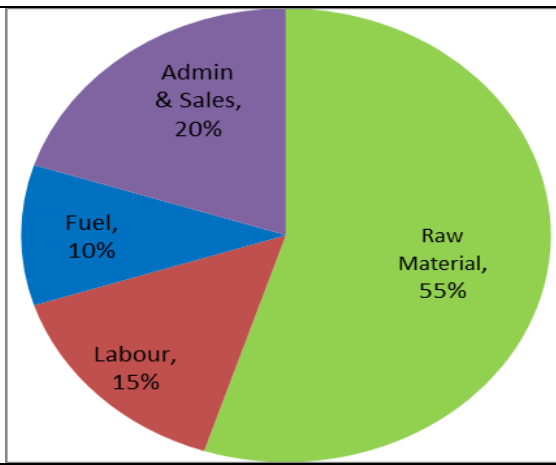
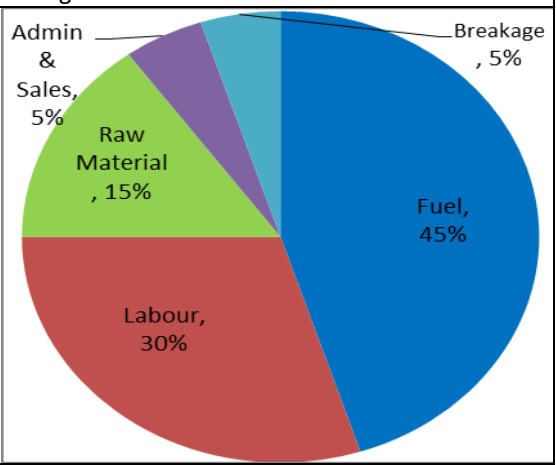
Salient features of AAC block: Leading to increasing acceptance of the product

The following salient features of AAC block make it user-friendly product over other construction materials:

Environment friendly	▪ Makes productive use of unavoidable waste - fly ash. ▪ Through the use of fly ash, AAC helps creation of a sustainable environment by reducing CO₂ emissions, agricultural soil erosion and water pollution. ▪ Non-polluting manufacturing process – does not exude gases, the only by-product is steam.
Light weight	▪ Three to four times lighter than traditional clay bricks, therefore, easier and cheaper to transport. ▪ Lighter block makes construction easier and faster.
Cost saving	▪ Being light weight, AAC reduces the dead weight of the building, resulting in to reduction in steel and cement on foundation structure work. Also allows construction of taller buildings. ▪ AAC's light weight saves on labour cost. ▪ Being bigger in size than clay brick, AAC wall construction involves less joints; thus, overall savings on mortar work. ▪ Automatic manufacturing process gives AAC a dimensional accuracy and smooth surfaces, eliminating need of three-coat plaster walls and allow for a very thin final coat.
Energy Efficient	▪ Energy consumption for producing AAC is less compared with production of other building materials. ▪ Tiny air pores and thermal mass of block provide thermal insulation, thus, reducing heating and air conditioning costs of a building.
Easy workability	▪ Available in custom sizes. ▪ Block can be easily cut or drilled to fit individual requirements. Accurate cutting minimises the generation of solid waste during use.
Others	▪ High strength, less breakage and less wastage. ▪ Fire resistant. ▪ Superior sound absorption due to porous structure of block. ▪ Pest and moisture resistant.

Use of AAC block in construction activities offers interesting proposition for various segments of the society. For a project developer, an AAC block means faster construction along with cost saving; for an environmentally conscious peoples, it means eco-friendly product and for those who occupy buildings built with AAC block, it means better safety and lower energy costs for cooling or heating.

A quick comparison between AAC block and clay brick

Parameter	AAC Block	Clay Brick
Production facility	State-of-the-art production facility	Unhealthy working conditions due to emission of toxic gases
Production cost break-up		
Sector and labour	Organised sector with statutory labour laws.	Unorganised sector with rampant use of child labour.
Soil consumption	Zero soil consumption. Primary raw material for AAC block is fly ash which is industrial waste generated by coal/lignite-based thermal power plants (TPP).	One clay brick consumes more than three kgs of top soil.
Fuel consumption and CO ₂ emission	One square feet with AAC block will consume 1 kg of coal. Lower greenhouse gas emission.	One square feet with clay brick will consume 8 kg of coal. Higher greenhouse gas emission.
Size	Available in custom sizes to fit individual requirements.	Available in fixed size.
Density	550-700 kg per cubic meter	Around 1,800 kg per cubic meter
Availability	Available throughout the year.	Since the drying and firing is done in open, the brick cannot be manufactured in rainy season; hence, it is mostly seasonal and operating for around 8 months in a year.
Tax contribution to exchequer	Contributes to government taxes in form of central excise and VAT.	Clay brick is non-excisable product. However, it contributes in form of VAT and royalty on earth mining to the state government.
Selling price	Around Rs.2,350/cubic meter during April 2015 (in and around Ahmedabad market)	Around Rs.2,090/cubic meter during April 2015 (in and around Ahmedabad market; considering 550 pieces of clay bricks as one cubic meter).

All the comparison parameters except selling price are in favour of AAC block which has led to gradual increase in the acceptance of AAC block in the Indian construction sector. Further, although the clay brick is comparatively cheaper, AAC block allows construction with speed and economy considering the benefits of natural lightweight and savings on foundation structure work, mortar work, labour and energy consumption. Furthermore, as the non-excisable products are likely to be costlier after implementation of Goods and Service Tax Act, the selling price of AAC block would become more competitive. Further, the issues attached with the key cost components

of clay brick (shortage of labour and increase in fuel cost) and cost-competitiveness of AAC block are likely to shape the future growth of brick-making industry in India.

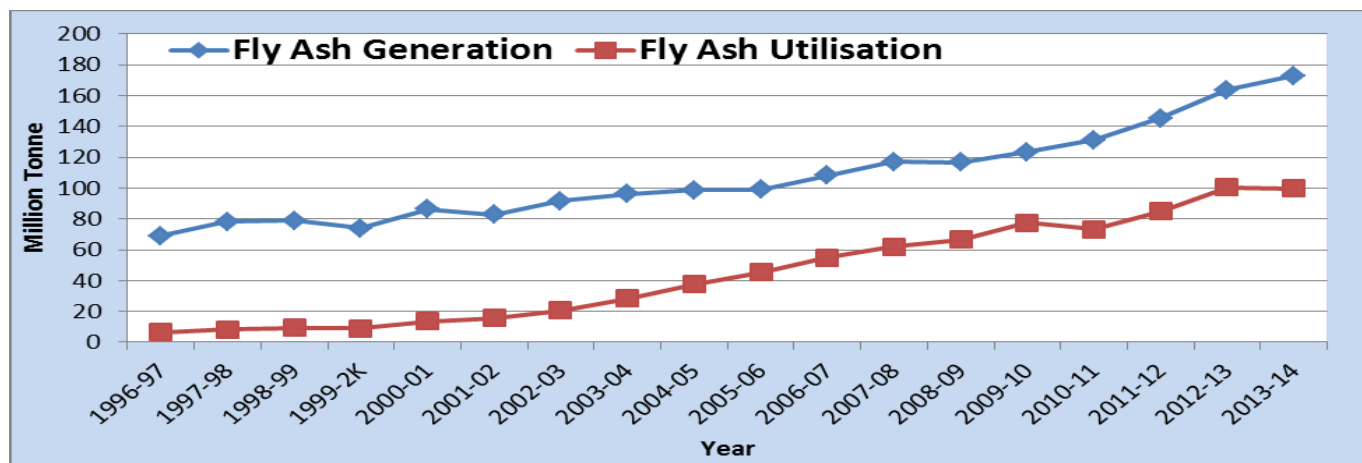
Fly ash: changing status from hazardous industrial waste to useful and saleable commodity

Fly ash, the major raw material for AAC block, is the waste of TPP. Coal/lignite-based thermal power generation has been the back bone of power capacity addition in India. Indian coal is of low grade with ash content of 30-45% in comparison with imported coal which has low ash content of 10-15%. Large quantity of fly ash is thus being generated at thermal power stations in country, which not only requires large area of precious land for its disposal but is also one of the sources of pollution of both air and water. Ash needs to be converted into ash-based products and utilised so that ash does not mix in air; it does not get washed away with surface water flow and also does not get leached to cause ground water pollution.

To address the above concerns and reduce the requirement of land for disposal of fly ash in ash ponds, Ministry of Environment and Forest (MoEF) has issued various notifications on fly ash utilisation with an aim to achieve 100% utilisation in phased manner. There have been concerted efforts by the government on development of new technologies for gainful utilisation and safe management of fly ash. AAC block manufacturing has emerged as one of the best applications of fly ash. As a result, fly ash earlier considered to be hazardous industrial waste material, has now acquired the status of useful and saleable commodity.

Fly ash generation and utilisation: AAC block won't allow the fly ash to fly away

As on March 31, 2014, there were 143 TPPs with installed capacity of 133,381 megawatt (MW) power generation in India. During FY14, TPP consumed 524 million tons (MT) of coal and generated 173 MT of fly ash with average ash content of 33.02%. Management of fly ash is a challenging task in view of large quantity of fly ash being generated at these TPPs. However, constant efforts from the government have increased the fly ash utilisation from 6.64 MT in 1996-97 (nearly 10% of total fly ash generated) to 99.96 MT in 2013-14 (58% of total fly ash generated) and gradually bridging the gap between generation and utilisation. Despite increased utilisation, ample fly ash is available and also expected to be generated in large quantities going forward which would assure the uninterrupted supply of it for the manufacturing of AAC block.

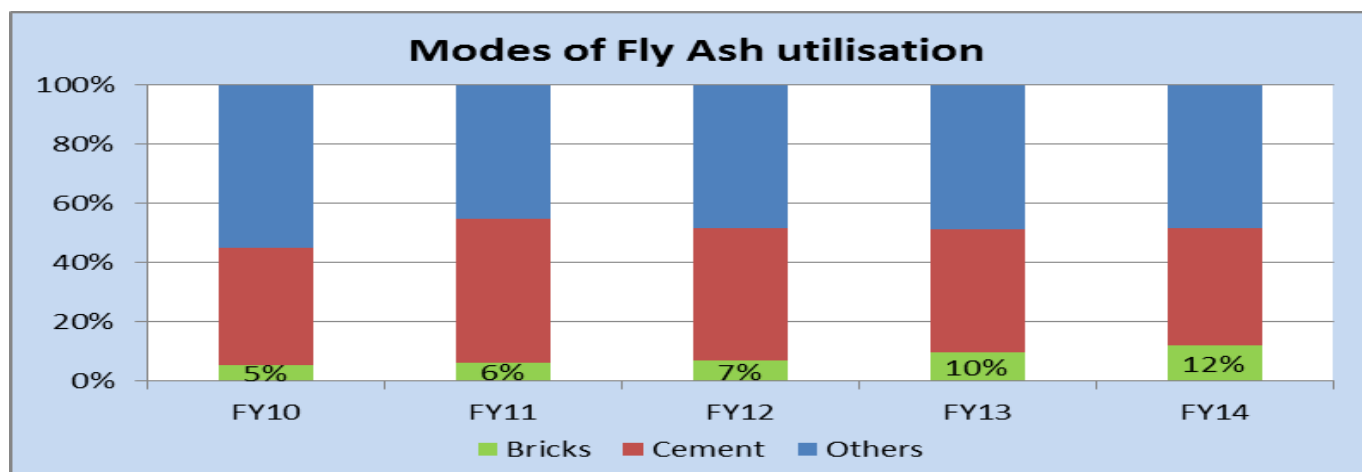


Source: Central Electricity Authority

The manufacturing of fly ash-based AAC block is one of the important areas for the effective management of fly ash. As AAC block is an emerging building material in Indian construction sector, it has high demand potential which may consume huge quantity of fly ash.

With a view to protect the environment, conserve top soil and prevent the dumping and disposal of fly ash discharged from TPP, the MoEF has issued notification for mandatory use of fly ash-based brick/block in all kinds of construction activities within a radius of 100 Km of a TPP. Further, MoEF has also stipulated that at least 20% of fly ash shall be made available free of charge to the units manufacturing fly ash-based products on priority basis over other users. These are the steps towards effective management of fly ash.

Considering the increasing acceptance of AAC block in India, the utilisation of fly ash for manufacturing AAC block has also increased three folds over past five years ended FY14.



Source: Central Electricity Authority

Other modes of fly ash utilisation include reclamation of low lying area, mine filling, roads and agriculture apart from rising of ash dyke.

Demand-supply scenario of AAC block

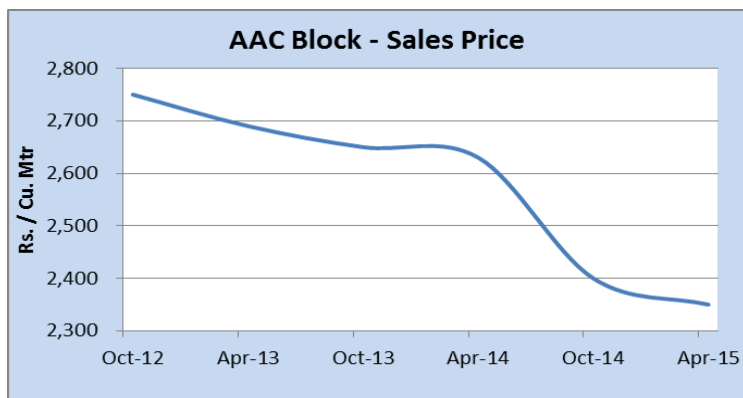
AAC block is a relatively new phenomenon in the Indian construction industry; however, it has started gaining popularity as a replacement of the traditional clay brick due to many desirable attributes. Although first AAC block manufacturing plant in India was set up in the early 1970s by Siporex India Pvt. Ltd. at Pune, it is only over past few years that the manufacturing and usage of AAC block has grown significantly.

As on March 31, 2010, there were around five AAC block manufacturing plants with installed capacity of around one million CMPA in India. However, eco-friendly nature along with the unique properties attached to the product has led to gradual increase in acceptance of the product in India. As on March 31, 2015, it is estimated that there are more than 70 AAC block manufacturing plants in India with total installed capacity of around 11 million CMPA and it is increasing gradually as the awareness about salient features and cost competitiveness of AAC block increases in the market. The AAC block manufacturing industry has changed many folds over past five years.

Despite significant growth in manufacturing capacities of AAC block over past few years, the market share of AAC block is miniscule compared with red clay bricks. The AAC block industry is estimated to be around Rs.1,500 crore for FY15 which translates to just around 2%-3% of total brick industry. Hence, there is huge potential for AAC block manufacturing industry to grow further over the medium to long term. Further, the fly ash being the key raw material is available in plenty at very minimal costs (only transportation charges), which assures uninterrupted manufacturing of AAC block and encourages fresh capacity addition in future.

Increasing competition resulting into pressure on realizations

There has been substantial addition of manufacturing capacities over past 2-3 years considering the salient



features and demand potential of the product going forward. AAC block manufacturing is also a low entry barrier business as an average capacity of 100,000 CMPA requires a tentative investment of around Rs.20 crore for Chinese technology plant and machinery leading to many small and regional players mushrooming in a short span of time. Hence, the competition in AAC market has

intensified over the period which has also resulted into price war in the market. There has been continuous

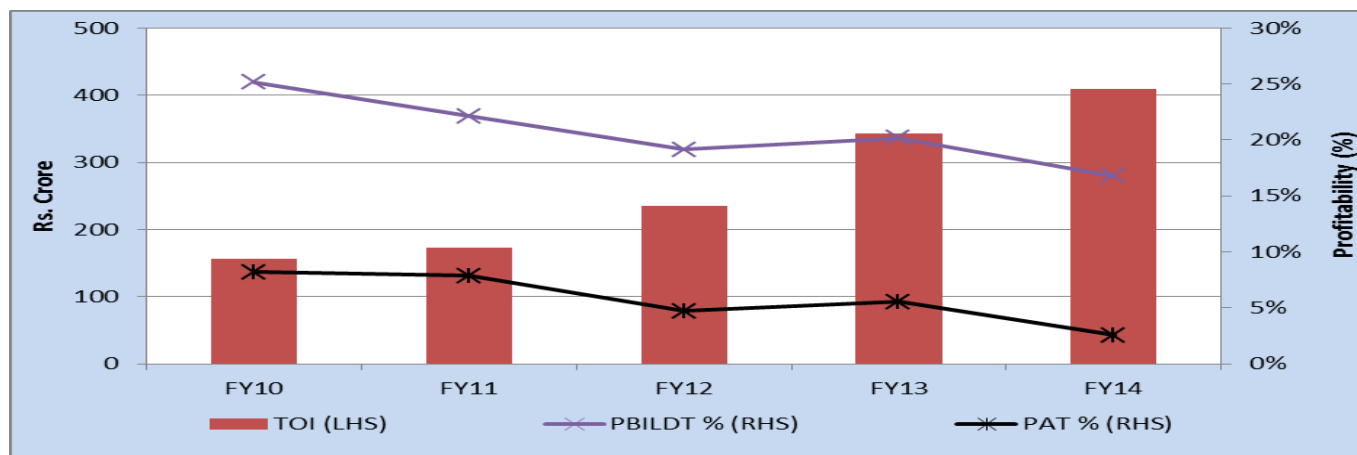
decline in the price of AAC block over past 2-3 years as shown in the chart; which also led to sharp drop in the operating profitability of AAC block manufacturers over the period. However, here it may be noted that continuous decline in sales price of AAC block has also helped to narrow down the gap with the sales price of cheaper clay brick which in turn has also led to increasing acceptance of the product.

The other risks related to the AAC block industry is logistic intensiveness of the product which forces the manufacturers to operate with three-four manufacturing plants at different locations to cater the different geographies and increase the market share. Moreover, the plant needs to be located in the vicinity of the TPP for uninterrupted supply of key raw material - fly ash at low cost (transportation costs). Furthermore, real estate construction activities is one of the major consumers of AAC block which exposes the manufacturer to the risks and cyclicity associated to the sector which is also currently passing through a sluggish market scenario.

AAC block also faces stiff competition from relatively cheaper clay brick which has been in use since many decades and has established presence with wider reach in the construction activities. Here, it may be noted that as the clay brick units depend on soil as major raw material, they requires lease from the Mines Department to mine soil. During FY14, the value of production of brick-earth was estimated at nearly Rs.2,729 crore, ie, 5.20% of the total value of production of minor minerals in India, which increased by nearly 13% over FY13. (*Source: Ministry of Mines*). Hence, as the promotion of AAC block would be at a cost of brick-earth mining revenue for the government; albeit AAC manufacturing earns excise revenue, it would be crucial to see the stance and support of the government for transformation of the traditional brick industry.

Financial performance of AAC block manufacturers

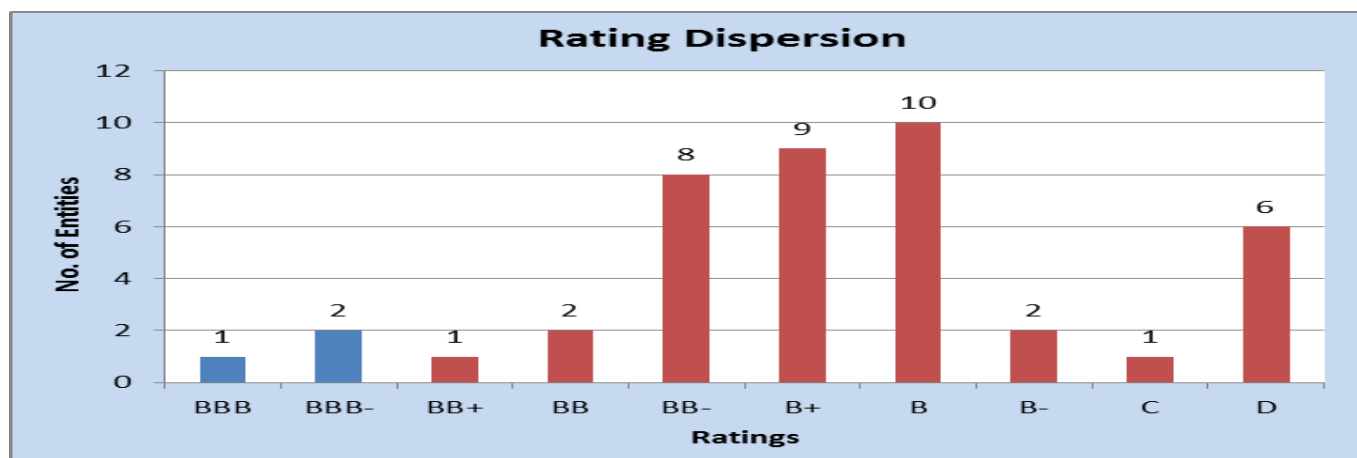
With increasing acceptance of the product in Indian construction activities, the AAC block manufacturers registered continuous growth in total operating income (TOI) over past five years. However, on the contrary, profitability has shown declining trend due to significant increase in installed capacities of AAC block in short span of time together with the strong competition from cheaper clay bricks.



Source: Company. These are financial aggregates of top three AAC manufactures of India who are solely engaged into AAC block business and have operational track record of more than five years.

On the back of increased competition together with the sluggish demand scenario in real estate sector over past one year, the profitability is estimated to have declined further during FY15.

Rating Dispersion



Out of the sample of 42 rated entities which are solely engaged in AAC block business; only three entities are in the investment grade rating category being the top AAC block manufacturers of India with operational track record of more than five years, whereas the remaining entities are in the non-investment grade rating category mainly on account of either being project phase entities or have short operational track record with small scale of operations.

The way forward

The demand for building materials is mainly driven by GDP growth. The growth in India's economy, population and urbanisation has resulted in an increasing demand for residential, commercial and industrial construction

which in turn has led to consistent growth in building material industry. Environment conservation has also become a key focus simultaneously as clay brick manufacturing is a source of environment pollution. Growing emphasis on environment sustainability is thus expected to spur the demand for AAC block. Further, the government's continued support, focus and encouragement for using green building products is expected to give an additional impetus to the growth of the evolving AAC block industry.

There is a huge demand potential for AAC block considering eco-friendly and cost-effective natured substitute product, increasing price parity against the conventional clay brick and its miniscule market share in overall brick industry. Furthermore, with the increasing awareness and acceptance for usage of green building products amongst developers and consumers coupled with the regulatory restrictions, non-availability of clay bricks in certain markets and anticipated growth in the real estate sector enhanced by Government of India's 'Housing for All by 2022' and 'Smart City' mission, the market for AAC block is expected to exhibit strong growth going forward.

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