Comparison of Analysis of Building with Conventional Bricks and AAC Blocks with Silicon Admixture

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Abstract— In most of the cases Autoclaved aerated Concrete block is stronger than a Conventional brick made of clay and both of them have their pros and cons. Kiln Burnt Brick is majorly used exterior wall material in the market. Also, Aerated Concrete (AAC) is a non combustible, cementatious building material that is expanding into new worldwide markets. Here we aimed to compare the environmental impact of materials- Kiln Burnt Brick and Autoclaved Aerated Concrete used for wall assemblies. The final objective is to evaluate the materials on the bases of Life Cycle Assessment. The permeability and hydrophilic nature of pressed concrete products leads to easy water penetration. Water penetration is a well-known factor affecting the performance and the durability of pressed concrete masonry. Efflorescence of concrete blocks is one of the problems associated with water penetration. Water repellent admixtures can minimize water movement within the concrete. The current research exhibits an admixture involving silicone nanotechnology using a silicone water repellent admixture. The nano-molecular polysiloxane lines the capillary walls of the concrete via strong siloxane linkages which overcomes the limitations inherent in traditional non-reactive admixtures resulting in long term durability of the hydrophobic treatment. The treated concrete achieves low water permeation and high efflorescence resistance. This innovative technology has achieved market success in creating pre-sealed decorative concrete blocks and pavers.

Key words: Life Cycle Assessment, Kiln Burnt Brick, Autoclaved Aerated Concrete, Life Cycle Assessment Impact Categories, Raw Material Index

I. INTRODUCTION

A. General

Brick masonry has been a primary technique used in building structures for at-least seven millennia, making it one of the oldest construction technologies in common uses. Its legacy in existing architecture still makes it a desirable, architectural choice in many locations. Although bricks are produced in numerous types, materials, and sizes which vary with region and time period, and are produced in bulk quantities, there are two most basic categories of brick, fired and non-fired bricks but, the image Indians typically associate with the word "brick" is clay fired brick, which are one of the longest lasting and strongest building materials a. This longevity stems from beneficial performance properties, widespread availability of clay, and the fundamental simplicity of brick production. Air dried bricks have a history older than fired bricks, are known by the synonyms mud brick and adobe, and have an additional ingredient of a mechanical binder, such as straw.

Recently, clay brick has come under a different kind of fire due to its environmental impact. While fired clay brick has certain inherent, sustainable properties (e.g. durability, high thermal mass, and, often, local extraction and manufacture), the kilning process fundamental to its manufacture has raised some sustainability concerns because of energy consumption and greenhouse gas (GHG) emissions. A green building needs special materials and systems to adapt sustainability when compared with a conventional building. Thus preference is now being given to greener and efficient building materials and Autoclaved Aerated Concrete is one such green material. It not only uses the waste material like fly ash but also provides adequate strength to structures. AAC was developed in 1924 by a Swedish architect, good thermal insulation, solid structure and easy to work with – but without the disadvantage of combustibility, decay and termite damage. The prime objective of the project activity is to reduce water penetration within AAC blocks to increase its life span by using silicon as admixture.

B. Aim and objective

The Paper is aimed to compare the environmental impact of materials- Kiln Burnt Brick and Autoclaved Aerated Concrete used for wall assemblies. The final objective of the paper is the protection of concrete structures by means of water repellent agents. One of the reasons for that is the better understanding of factors such as chemical reactivity and physical properties of the silanes which determine the performance and durability of water repellent treatments and increase the life span of aerated concrete blocks.

While attaining the prime objective the project activity will also give,

1) Reduce GHG emissions associated to energy consumption (both fossil fuel and electricity) in the high energy intensive BTKs by an energy efficient brick making technology.
2) Reduce air pollution by introducing robust air treatment facilities in the project activity; the clay brick kiln technology is adopted by an unorganized sector with very poor air treatment facilities; and
3) Enhance the use of fly ash, an industrial -waste, as an ingredient of building material. The project activity entails production of AAC blocks, which is a steam-cured mix of sand or pulverized fuel ash (PFA), cement, lime, anhydrite (gypsum) and an aeration agent. The high pressure steam-curing in autoclaves achieves a physically and chemically stable and light weight product, comprising myriads of tiny non-connecting air bubbles which give AAC its diverse qualities and makes it such an excellent insulating material.
4) Production process of AAC blocks does not involve sintering or kiln heating for blocks consolidation and

thus completely eliminates the burning of fossil fuels as required in the clay brick production by adopting the green waste mixing technology in PFA slurry process, ultimately contributing to the reduction of greenhouse gas emissions. The core of this technology is the AAC blocks composition and its chemistry, with fly ash from thermal plants mixed with lime and gypsum, which enable the blocks to acquire the mechanical properties required during the hydration and curing process without being sintered.

5) The moisture characteristics, long-term performance and service life, and degradation processes and ageing characteristics of porous building materials with and without water repellent treatments.

C. Overall comparison

1) It is apparent that masonry units with the least or no clay content (i.e. AAC blocks which contains waste material such as Fly Ash) have low impact. Density also influences raw material impact, thus AAC blocks resulting from the aerated nature (approximately 80% air) have lower raw material impact. Larger block size reduces the quantity of mortar wastage on construction site. Additionally, the raw materials that are consumed are generally abundant and found in most geographic regions, allowing them to be locally sourced. Furthermore, much of the raw materials used in AAC production may consist of recycled materials, including copper mine tailings and fly ash, a byproduct of coal-fired power plants.
2) AAC blocks use cement in the production process and require curing. However, steam curing under high pressure (autoclaving) results in significantly lower water consumption. Larger block size reduces the quantity of mortar used in construction and thus the water requirement on site. Whereas, Water requires for curing Brick Masonry for 7 days is much large, thus the water consumption increases.
3) Burnt bricks show much higher embodied energy compared to AAC Blocks. The thermal performance of AAC wall assembly is also generally superior to Burnt bricks as reflected in the U-values. AAC blocks wall assembly have the lower U-value due to the porous nature of the material.
4) Burnt brick production is traditionally a labour intensive process. The use of manual labour for moulding therefore results in significantly lower productivity compared to mechanized processes. Block size also influences construction productivity and a larger block size requires less time and effort for construction. Poor conditions for labour at brick kiln sites are reflected in OHS index compared to AAC. Units producing AAC Blocks are generally located close to large urban areas and do not require labour to live on site during the production period as in the case of Burnt Brick.
5) Cost of AAC block is higher but the overall cost of the construction reduces drastically. Due to the larger block size of AAC masonry reduces the mortar quantity contributing to lower cost for the wall assembly. Also due to its lightweight characteristics the steel consumption reduces by 0.4kg which lower the total cost of construction.
6) CO2 emissions are lower for AAC Production and Wall Assembly compared to Burnt brick Walls and its production. Also, Resource Consumption of AAC is lower and thus the CO2 emissions reduces.

II. BACKGROUND OF PROJECT

Aerated concrete block has the water absorption is extremely high, indeed more than what the IS code specify. This aspect is detrimental to the performance in terms of durability. Perhaps there is a need for the manufacturers to look into this aspect in great detail; otherwise the low density benefit will be offset by the unwanted need to protect it by water ingression. External wall surfaces made of porous mineral building materials deteriorate by the effect of rain, temperature cycling, sunlight and atmospheric pollution. In organic mineral building materials have more or less a porous structure and absorb water to a certain extent. Water absorption is almost always involved in all types of degradation mechanisms of mineral building materials which may be physical, chemical or biological in nature, or even combinations of these. Therefore, porosity and in turn, permeability have a major effect on durability and service life. The use of surface treatments mainly aims to improve the weather resistance and in turn, the long-term performance of building materials.

The most efficient way of protecting concrete is to prevent water uptake. Alkoxy silanes are the most common commercial adhesion promoters and are commonly used to enhance the adhesion between polymeric and inorganic materials. They contain two types of reactivity in the same molecule: an inorganic and an organic reactivity. This combination allows the silane to act as a bridge at the interface of an inorganic substrate and an organic material to bond the two dissimilar materials together. Benefits from using silane coupling agents include increased strength and humidity resistance of coatings and adhesives, better wetting of inorganic substrates, lower viscosities during compounding, smoother surfaces of composites, less catalyst inhibition of thermoset composites, clearer reinforced plastics, and an interphase region that is more resistant to chemical attack from the surrounding environment. The silicon-based water repellants are considered as the best protective agents against failures associated with moisture. They are claimed to satisfy requirements as:

1) High resistance to water penetration
2) Minimal reduction in vapour permeability
3) Good adhesion
4) Resistance to UV (excellent durability)
5) Environmental compatibility (solvent-free)
6) No change in appearance.

III. BENEFITS

1) Repair Is the Most Expensive Solution Repairing concrete structures is up to ten times more expensive than preventive measures such as hydrophobic impregnation. With Silicon admixture innovative technology for the water-repellent treatment of

concrete, it's possible to prevent repair and so avoid high costs and consumption of energy and resources.
2) Only effective preventive measures such as hydrophobic impregnation provide reliable protection for concrete structures.
3) Use of silicon admixtures causes cost efficiency, durability and scope for design, have made concrete today's most widely-used building material.
4) Positive public acceptance due to exemplary environmental compatibility.
5) Forms a barrier to chlorides from road salt.
6) Reinforcement steel does not rust, since the passivation layer remains intact.
7) Frost damage is minimized thanks to highly effective water repellency.
8) Treatment reduces energy consumption by minimizing maintenance work and the associated site set-up costs.
9) Lower water and energy consumption is kind on the environment.
10) Buildings treated with Silocon admixtures have an extended lifespan.

IV. CONCLUSION

Aerated light weight concrete is unlike conventional concrete in some mix materials and properties. Aerated lightweight concrete does not contain coarse aggregate, and it is possess many beneficial such as low density with higher strength compared with conventional concrete, enhanced in thermal and sound insulation, reduced dead load in the could result several advantages in decrease structural elements and reduce the transferred load to the foundations and bearing capacity. Comparative Analysis indicates that in almost all the parameters except, water absorption the AAC blocks have a superior edge over burnt clay bricks. Comparative Analysis indicates that in almost all the parameters except, water absorption the AAC blocks have a superior edge over burnt clay bricks. The Addition of the silicone water repellent admixture into pressed concrete imparts dry wall, significant water repellency. Efflorescence of the concrete was effectively controlled. Silicone treatment reduces energy consumption by minimizing maintenance work and the associated site set-up costs. Prevention by costly repair Buildings treated with silicone has an extended lifespan.

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