A Study on properties of Autoclaved Aerated Concrete for feasibility in construction

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***Abstract*- Autoclaved Aerated concrete (AAC) have a lot of profit used for structure such as heat insulation, sound insulation, fire as well as mould confrontation, abridged dead load as well as a lot more. AAC products take in block, wall panel, ground also top panels, also lintels. as well insulate ability, one of AAC's compensation in creation is its fast with simple setting up while the material can be routed, sand also slice to dimension on site by normal carbon steel band saws, hand saws also drills. Although ACC is being created for a lot of years, here are still a little point so as to need to be clarify. One of these points is humidity intrusion effects on AAC members in areas with high relative humidity levels of Mediterranean climates which are important in durability and insulation properties of AAC. This work presents the identify the usage of AAC in construction projects. This work also provides the economical comparative analysis with clay bricks as well as AAC blocks, and how AAC block is effective that clay bricks. This work also can improve the sound insulation of internal and external wall. The experimental analysis shows the test results of proposed system with internal as well as external walls.**

Index Terms- Autoclaved Aerated Concrete, surface treatments, water repellants, degradation, moisture properties, concrete, humidity, sound acoustic, decibel.

I. INTRODUCTION

Autoclaved Aerated Concrete can too be name as AAC also is an essential creation objects for architect, engineers as well as builders. As well, it is an suitable objects with high power effectiveness, fire security, also price competence. Main discoverer of AAC be a Swedish Engineer who formed AAC in 1922. built-up of solid by haze force go backside to 1880, while AAC was bring to Germany, manufacturer be face troubles to discover a appropriate technique for callous this objects, and German engineer solved this problem by introducing a new method known as Wire Cutting which increased the rate of production for AAC. After production of that cutting strategy, AAC turned into a satisfactory material regarding Germany's firm vitality codes. AAC had no standard code of training and this deferred presentation of it into USA advertise. Second generation of AAC was finished by Yong in 1997 in Germany. AAC square is utilized in a wide scope of business, modern and private application and has been being used in EUROPE more than 90 years, the Middle East for as long as 40 years and in America and Australia for a long time. 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 generation of AAC square began in 1972.AAC is a light weight, high quality building material and is created in an assortment of structures from squares, to auxiliary floors and divider boards. AAC is credited by LEED (Leadership in Energy and Environmental Design) and USGBC (US Green Building Council) as a "GREEN" option in contrast to customary development materials. Indian Green Building Council (IGBC) prescribes its utilization in India.

In ancient times, man began taking sanctuary in caverns, unearthed subterranean dimension and under hanging mountain precipices and this sort of asylum just given safe place from ecological furthest points. The idea of security and wellbeing according to basic highlights of safe house were totally out of brain. With the advancement and development of human personality, man started to adjust the basic arrangement of haven in order to address the expanding needs and offices which an ideal safe house configuration had. Subsequent to accomplishing an accomplishment by the utilization

of effectively accessible material like mud in developing dividers and afterward the procedure of consumed mud block brick work to frame auxiliary piece of asylum, there was as yet a long voyage approaching out for the most ideal basic material for development of stable and safe structural units of shelter.

II. PROBLEM STATEMENT

This work carried out mapping the mechanical as well as physical properties of Autoclaved Aerated Concrete (AAC), and how it works in different humidity level. It also shows the comparative analysis with different humidity factors for inside and outside sound level.

III. OBJECTIVES

- To study and understand certain material properties of AAC manufactured blocks
- To improve the sound insulation of internal and external wall.
- To study uses of AAC in construction
- To investigate feasibility of AAC in construction
- To construct economical buildings (cost comparison) by replacing clay bricks by AAC blocks.
- To make productive use of recycled industrial waste (fly ash).

IV. LITERATURE REVIEW

According to [1] define a Typical AAC density is between 300 and 1,000 kg/m3 (in a dry condition). Circulated air through cement has no coarse totals in its blend, and it very well may be referenced that circulated air through lightweight cement is the solid mortar which is circulated air through with fine and little rises from a compound procedure or by utilizing air entraining specialist. Autoclaved circulated air through cement is made of concrete, silica sand, brisk lime and gypsum and aluminum powder.

According to [2] proposed the positive acoustic properties of autoclaved aerated concrete as such can be attributed to its internal structure, however, its density is relatively low, which is why the sound protection execution of AAC allotments can be more terrible than that of dividers of a similar thickness made of different materials (e.g. normal concrete, etc.)According to [3] considering methods of curing, aerated concrete can be categorized into two main groups which are autoclaved aerated concrete and non-autoclaved aerated concrete. Curing is an important factor affecting mechanical and physical properties of concretes in different categories. According to different reports, AAC can reach higher strength values with less drying shrinkage when it is compared to non-autoclaved aerated concrete (NAAC). Therefore, it can be concluded that autoclaving process has beneficial effects on strength development and also on shrinkage of aerated concrete.

According to [4] Raw materials which are appropriate for autoclaved aerated concrete are fine grading materials. Silica or quartz sand, lime, cement and aluminum powder are main raw materials for producing AAC. Silica sand's percentage is higher than the other aggregates in aerated concrete mix. Both silica and quartz sand are mineral based aggregates which can be obtained from broken rocks or granites. At the same time flyash, slag, or mine tailings can be used as aggregates in combination with silica.

According to [5] Autoclaved aerated concrete has excellent noise reducing ability and causes reduction in sound transmission. Porous structure of AAC contains millions of air bubbles which restrict sound penetration inside the wall and because of this property autoclaved aerated concrete has better sound insulation capacity than normal concrete.

According to [6] Compressive strength of AAC is an important parameter in construction and design. Compressive strength tests were carried out by applying axial load on AAC cubes. For this test AAC cubes were cut into desired dimensions by using cutting machine, to obtain sample with dimensions of 150×150×150 mm and 50×50×50 mm. This test was carried out on samples with three different humidity conditions of 6%, 50% and 100%. For each humidity condition, four 150 mm cubes and four 50 mm cubes were tested. Procedures of this test were based on TS-EN 679 standard.

According to [7] since AAC is lightweight material with porous structure both plastering and coating have beneficial effects on sound transmission loss because of increasing in air flow resistivity. Results indicated that for different sound levels sound transmission losses change parallel to sound levels

inside the chamber and it is understandable that there is no resonance in acoustic properties of AAC walls.
According to [8] TS-EN 679 standard optimum humidity content for AAC blocks which will be tried under pivotal load is 6%. Then again, with expanding the temperature within the heater dampness content diminished in view of vanishing process and caused diminishing in load of squares and furthermore some corruption in pore. Reports express that in cements with lime and silica-based materials changing the temperature causes changes in shade of solid, nearness of silica sand and lime in AAC causes these color changes with increasing the temperature inside the furnace.

V. AUTOCLAVED AEREATED CONCRETE

This work is based on properties of autoclaved aerated concrete and evaluating humidity intrusion effects on properties of AAC. This segment contains data about assembling process, crude materials, points of interest and furthermore uses of autoclaved circulated air through cement.

AAC Manufacturing Process
Assembling procedure of AAC has numerous likenesses to creating precast cement. This procedure contains 5 principle steps which are as following:
1) Mixing of raw materials.
2) Addition of expansion agent.
3) Pre-curing, cutting.
4) Curing process with autoclave.
5) Packing and transporting.
Mixing of Raw Materials In this piece of assembling process, fine totals like silica sand or quartz sand and lime are blended with bond. In this piece of assembling process, fine totals like silica sand or quartz sand and lime are blended with bond. Then water will be added to this mix and hydration starts with cement forming bond between fine aggregates and cement paste. every one these process take place in a massive container.
Addition of Expansion Agent In the wake of blending process, extension operator is added to the blend for expanding its volume and this expansion can be from 2 to 5 times more than unique volume of the paste. Extension specialist which is utilized for this procedure is aluminum powder; this material responds with calcium hydroxide which is the result of response among bond and water. This response between aluminum powder and calcium hydroxide causes shaping of infinitesimal air bubbles which brings about expanding of glues volume. These minute air pockets will expand the protection limit of AAC.

Table 1 Raw Material Used and Their Percentage

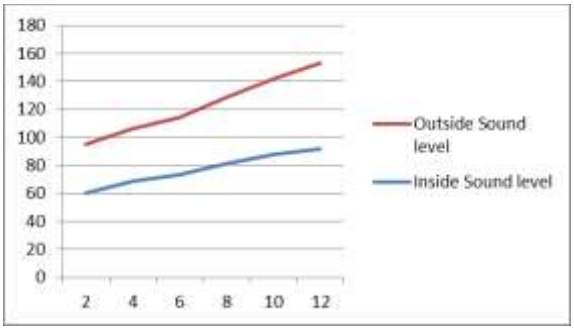
SR. NO.	Material	% of proportion for AAC Blocks with Fly Ash / with Sand
1	Fly ash / Sand	65-70 / 55-65
2	Cement – 53 GRADE OPC	6-15 / 10-20
3	Lime	18-25 / 20-30
4	Gypsum	3-5 / 2-3
5	Aluminum powder paste (600 kg/m3)	8 %
6	Water	0.6-0.65
7	Casting System	36-40 ° C / 35-38 ° C

Pre-curing and Cutting Pre-curing process starts after concrete mix is poured into metal moulds with dimensions of 6000 mm × 1200 mm × 600 mm. In these moulds, concrete will be pre-cured after it is poured into mould to reach its shape and after this pre-curing process cutting will take place. Cutting will be finished with wire shaper to stay away from distortion of cement amid process.
Curing Process by Autoclave is characterized as a solid, pressurized and steam-warmed vessel. “quartz sand should react with calcium hydroxide that evolves to calcium silica hydrate causing material to reach its fixed mechanical and physical properties” [1]. Curing with autoclaving strategy requires three principle factors which are dampness, temperature and weight. These three variables ought to be connected on material all in the meantime.
Packing and Transporting After completion of mentioned processes, autoclaved aerated concrete is ready for packing and transportation, but the important factor that shall be carefully considered for this process is that; material should be cooled down for packing and transporting.

VI. RESULTS AND DISCUSSION

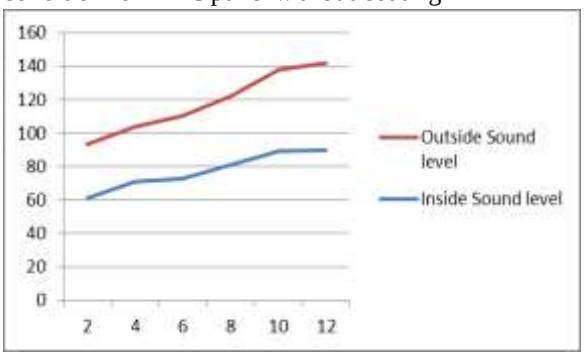
Sound Insulation Test
Sound insulation tests were carried out on AAC panels under three different humidity conditions to determine effects of humidity on acoustic properties of AAC. Measuring sound transition loss (TL) is the main purpose of sound insulation test. Although mass

and stiffness are the most important factors affecting sound transmission losses of partitions and floors, humidity can also be a factor which can influence sound transmission. As indicated by specialized report CBD-239; "in a twofold layer get together, for example, gypsum wallboard on wood or metal confining, the profundity of air spaces, the nearness or nonappearance of sound engrossing material, and the level of mechanical coupling between layers basically influence sound transmission misfortunes and the sound transmission class.



X= Number of tests, Y= sound Level

Fig-1: Sound transmission loss at 55% humidity condition for AAC panel without coating



X= Number of tests, Y= sound Level

Fig-2: Sound level transmission loss at 55% humidity condition for AAC wall with coating

The below Table 2 shows the Effect of humidity on outside sound levels for AAC wall without coating

Table-2: Effect of humidity on outside sound levels for AAC wall without coating

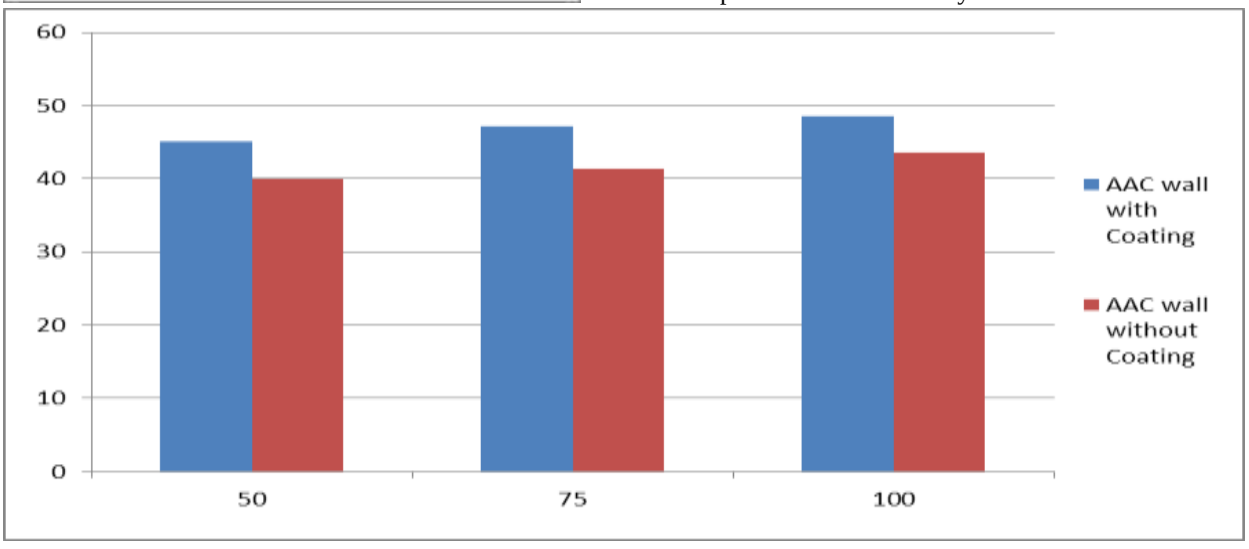
Test No.	Inside humidity (%)	Average of outside sound level(db)
1	55	45.10
2	75	47.20
3	100	48.50

As demonstrated the mortar on circulated air through solid dividers with tongue and furrow joints has explicit sound protecting properties. Circulated air through cement was additionally affirmed to transmit sound, even at higher densities, which implies that the sound protection execution of mortar free dividers is lower than that of put brickwork, notwithstanding when the joints are loaded up with mortar. The difference in the values of sound reduction indices is considerably higher than what would be implied by the increased surface density (mass per unit area) of the plastered wall.

Table-3: Effect of humidity on outside sound levels for AAC wall with coating

Test No.	Inside humidity (%)	Average of outside sound level(db)
1	55	40.05
2	75	41.35
3	100	43.60

The below figure 3 show the overall comparison between AAC wall with coating as well as AAC with without coating result, it shows the sounde level comparison when humadity is different.



X= Humidity level, Y= sound Level
Fig-3: Effect of coating in decreasing sound levels

VII. CONCLUSION

Results indicated that increasing humidity condition within the chamber causes reductions in average sound transmission losses of AAC wall. Also, for different sound levels, sound transmission losses change parallel to sound levels inside the chamber and it is understandable that there is no resonance in acoustic properties of AAC walls. Considering advantages of AAC in energy savings and price effectiveness are beneficial to find the way for counteract humidity intrusion effects on AAC's physical and mechanical properties. According to test results coating is the most important factor for improving resistivity of AAC walls, and these factors help AAC walls to keep their mechanical and physical properties against humidity. With its shut air pockets, AAC can give great sound protection. Likewise, with all stone work development, care must be taken to maintain a strategic distance from holes and unfilled joints that can permit undesirable sound transmission. Consolidating the AAC divider with a protected pit framework will furnish a divider with magnificent sound protection properties.

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