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A REVIEW PAPER ON LIGHT WEIGHT AUTOCLAVE AERATED CONCRETE BLOCK

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Abstract:- *AAC blocks are light weight Aerated Autoclave Concrete Block. It is manufactured through a reaction of aluminium powder and a proportionate blend of lime, cement, and fly ash or sand. AAC is a masonry material that is lightweight, easy to construct, and economical to transport. The usage of AAC block reduces the cost of construction up-to 25%. The weight of autoclave aerated concrete is much lesser than the conventional brick, by using this advantage we think, we can reduce the weight of infill wall on beams, columns, footings if conventional bricks replace by AAC block and simultaneously we can save reinforced steel.*

The very low weight of this material and its high deformability (low value of Young modulus in compression) tends to reduce inertia forces on the building induced by the seismic motion. On the other hand the masonry compressive strength of AAC, although its variability is extremely limited, is rather low compared to other traditional masonry types.

This study deals with the manufacturing process And Seismic performance of the autoclaved aerated concrete blocks.

1. INTRODUCTION :-

Autoclaved Aerated Concrete (AAC) is one of the eco – friendly and certified green building materials. AAC is porous, non-toxic, reusable, renewable and recyclable. AC is commonly found as masonry block units, The AAC block material was introduced in 1924 in Sweden by John Axel Eriksson. It has a high percentage of air, making up its volume and the materials that are used to make it can be recycled from the waste AAC material. Recycled AAC can be ground up finely and can be used as the aggregate in the new mixture. AAC is used in many building constructions, such as in residential homes, commercial and industrial buildings, schools, hospitals.

Masonry structures are commonly associated with poor seismic performance as observed in past earthquakes. This negative perception is caused mainly by many non-engineered masonry structures, mostly stone masonry houses which, if not properly designed and/or strengthened regarding seismic provisions, will not behave satisfactory under seismic excitations.On the contrary, modern approaches to masonry constructions regarding seismic detailing with convenient conception or innovative materials and solutions, may lead to safer and economical constructions especially concerning small constructions. Therefore a complete methodological approach to the seismic performance assessment of unreinforced AAC masonry buildings is presented on this work, enhancing the possibility to use nonlinear static procedures in the reproduction of the dynamic behaviour of AAC masonry buildings.

The raw materials used for preparation of AAC blocks are fly ash, cement, gypsum, lime and aluminum powder. Being aerated, AAC contains 50 - 60 % of air, leading to light weight and low thermal conductivity. AAC Blocks offers incredible opportunities to increase building quality and at the same time reduce costs reduced reinforcement requirement, reduced size of structural members,reduced brick required and indirect factors like reduced plastering width, and less morter required for Brickwork.

OBJECTIVE:-

1. Clay Brick is replace by AAC block.
2. Reduced cost of construction.
3. Reduced size of structural members.
4. Makes Structure light in weight hence improve seismic performance.
5. Reduction in Dead weight.
6. Time Saving in Construction.
7. Makes earthquake resistant light weight structure.
8. To use AAC it is extremely resource-efficient and ecofriendly.

MATERIALS:-

Raw materials used in manufacturing of AAC blocks

1) Cement : Cement is a binder, a substance used in construction industry that sets and hardens and can bind other materials together

2) Water: Potable water should be used which should conform with the general requirements of the concrete.
3) Fly ash or sand:Fly ash is mixed with water to form fly ash slurry. Slurry thus formed is mixed within other ingredients like lime powder, cement, gypsum and aluminium powder in proportionate quatity to form blocks

4) Quick Lime: Lime powder is obtained either by crushing limestone to fine powder at AAC factory or by directly purchasing it from the market.
5) Gypsum: Gypsum is easily available in the market and is used in powder form.
6) Aluminium Powder: Aluminum is an expansion agent.

2. MANUFACTURING PROCESS:

Mixing of raw materials:

In this part of manufacturing aggregates like silica sand or quartz sand and process, fine lime are mixed with cement. Then water will be added to this mix and hydration starts with cement forming bond between fine aggregates and cement paste. All these processes take place in a huge container

Addition of expansion agent:

After mixing process, expansion agent is added to the mixture as shown in figure 1 for increasing its volume and this increase can be from 2 to 5 times more than original volume of the paste. Expansion agent which is used for this process is aluminum powder; this material reacts with calcium hydroxide which is the product of reaction between cement and water. This reaction between aluminum powder and calcium hydroxide causes forming of microscopic air bubbles which results in increasing of pastes volume. These microscopic air bubbles will increase the insulation capacity of AAC.

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 done with wire cutter to avoid deformation of concrete during process. Aerated concrete blocks are available in different dimensions and various thicknesses. Dimensions for these blocks which are commonly used are: 600×250×100 mm, 600×250×150mm, and 600×250×200.

Curing process by autoclave

Autoclave is defined as a strong, pressurized and steam-heated vessel. Concrete mix that is categorized as autoclaved has its ultimate mechanical properties conditions. In order to reach the ultimate mechanical characteristics for AAC, Domingo states, Curing with autoclaving method requires three main factors which are moisture, temperature and pressure. These three factors should be applied on material all at the same time. Temperature inside autoclave should be 1900C and essential pressure should be about 10 to 12 atmospheres. Moisture will be controlled by autoclave and this process should be continued up to 12 hours to provide proper condition for hydration.

Packing and transporting

After completion of mentioned processes, autoclaved aerated concrete is ready for packing and transportation, but the important factor is that ; material should be cooled the cut blocks are then loaded into the autoclave. It takes a couple of hours for the autoclave to reach maximum temperature and pressure, which is held for perhaps 8-10 hours, or longer for high density/high strength aircrete.

3. EXPERIMENTAL TEST:

WATER ABSORBTION TEST

Water absorption test was conducted at the AAC blocks of 4" and 6" as shown in table 1.

Table 1 Water absorption Test for AAC blocks

S.No	Days	AAC Blocks (4") (%water absorbed)	AAC Blocks (6") (%water absorbed)
1	3	33.23	18.6
2	7	28.54	20.27
3	14	23.32	22.4
4	28	20.22	19.67

COMPRESSIVE STRENGTH TEST

Compressive strength test was conducted for 200X 200 specimen shown in table 2.

Table 2 Compressive strength of AAC blocks

S.NO	Size of Specimen (mm)	Max Load (kN)	Compressive strength (N/mm2)
1	200X200	147	3.64
2	200X200	162	3.72
3	200X200	153	4
		Average	3.78

FLEXURAL STRENGTH TEST

Flexural strength test was conducted at the AAC blocks of specimen of 600X200X200 as shown in table 3.

Table 3 Flexural Strength for 8" Blocks

S.NO	Size of Specimen (mm)	Max Load (kN)	flexural strength (N/mm2)
1	600x200x200	65	0.72
2	600x200x200	63	0.7
3	600x200x200	59	0.65
		Average	0.69

PARAMETERS OF AAC BLOCK:

Parameters	Details
Sizes	60x20x7.5, 10, 12.5, 15, 17.5, 20, 22.5 cm
Dry Density	551-600 kg/m3
Compressive Strength	3-4 N/mm2
Usage Of Material	A block wall requires 10 blocks per square metre.
Consumption of Cement Mortar	0.77 bags of cement / Cu. m
Cost Variation	A block wall will cost 800rs per sq. m

ADVANTAGES:-

1) Lightweight It is 4 times lighter than traditional bricks and hence, easier and cheaper to transport..

2) FireResistant: Just like the regular concrete, AAC is fire resistant. This material is completely inorganic and not combustible.

3) LowMaintenance: AAC reduces the operating cost by 30% to 40%. It also reduces overall construction cost by 2.5% as it requires less jointing and reduces the quantity of cement and steel.

4) EnergySaver: It has an excellent property that makes it an excellent insulator.

5) Eco friendly: AAC helps to reduce at least 35% of ecological waste as compared to traditional concrete.

There is a decrease of 50% of greenhouse gas emissions.

6)EarthquakeResistant: As the impact of the earthquake is directly proportional to the weight of the building, the building constructed using AAC blocks are more reliable and safer.

3. CONCLUSION :-

1) AAC Blocks have an attractive appearance and is readily adaptable to any style of architecture. Almost any design can be achieved with AAC.

2) As the impact of the earthquake is directly proportional to the weight of the building, the building constructed using AAC blocks are more reliable and safer.AAC blocks are highly superior in terms of the strength.

3) AAC block weighs almost around 80% less as compared to the conventional red brick.

4) These blocks are good for construction than red clay bricks. Hence cost, quality, labor and time has been compared and suggestion from this paper is to use AAC blocks for construction.

5) AAC is manufactured from common and abundant natural raw materials, therefore it is extremely resource-efficient and eco - friendly. Cost of construction reduces by maximum up to 20 %.

6) Density of AAC block is 1/3 that of traditional clay brick

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