International Journal of Research in Advent Technology (IJRAT)
(E-ISSN: 2321-9637)
Special Issue National Conference "CONVERGENCE 2018", 09th April 2018

Comparative Analysis of G+10 RCC Building with Conventional Blocks and AAC Blocks

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Abstract-A building can be defined as an enclosed structure intended for human occupancy. Constructions work can be seen in almost all the developing countries. With the increases in material cost in the construction work, there is a need to find more cost saving alternatives so as to maintain the cost of construction houses , multi-storey etc, which can be affordable to people. In the manufacturing of burnt clay bricks, smoke evolved at a great extent and also some toxic gases which can harm an environment. So as to overcome with all these problem, Autoclaved Aerated Concrete (AAC) blocks are used which is more economical and eco-friendly. This project includes the analysis, design and estimates of structure, comparing between autoclave aerated concrete and conventional brick in the form of steel consumptions. Autoclaved Aerated Concrete (AAC) is a lightweight concrete building material cut into masonry blocks or formed larger planks and panels. Currently it has not seen widespread use in the United States. However, in other parts of the world it has been used successfully as a building material. Cost of construction is reduced and it will be safe and economical in earthquake forces also. The seismic Parameter Lateral displacements are also compared.

Index Terms- conventional blocks and AAC block ,diagonal strut, infill wall with opening , E-Tab software

1. INTRODUCTION

Brick has the building material for construction and the structural Analysis is the most commonly used. There are the brick is just only a partition member in building. Further, although the clay brick is comparatively cheaper as compared to 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. Therefore, the focus should be now more on seeking eco – friendly solutions for green environment. the Analysis of burnt clay brick and non – conventional material on cost, energy consumption and carbon emission parameters helps in construction analysis options for sustainable construction. AAC block, gives a prospective solution to building construction. In this paper, attempt has been made to replace the red bricks with eco – friendly AAC blocks. The use of AAC block reduces the cost of construction up to 20% as reduction of dead load of wall on beam and column makes it a comparatively lighter members and reducing the loads or moment. The use of AAC block also reduces the requirement of materials such as cement and sand up-to 50%.

ETABS stands for Extended Three Dimensional Analysis of building. Comparison of analysis and design of regular and irregular configuration of multi storied building in various seismic zones using ETABS software. ETABS has the present rising software in structural analysis is design software in the market. Many constructional company's useing this software for analysing and determing the load and moment at every member. So, this paper mainly deals with the comparative analysis of the results obtained from the analysis of a multi storied building structure when analysed manually and using ETABS software. The effective design and construction of an earthquake resistant structures have great importance all over the world. This project presents multi-storeyed residential building analysed or designed with lateral loading effect of earthquake using ETABS. This project is designed as per INDIAN CODES- IS 1893-part2:2002, IS 456:2000.

Structural response to earthquake depends on Dynamic characteristics of the structures and intensity, duration and frequency content of existing ground motion. Structural analysis means determination of the general shape and all the specific dimensions of a particular structure so that it perform the function for which it is created and will safely withstand the

influences which will act on it throughout its useful life.

1.1. AERATED AUTOCLAVE CONCRETE

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. 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, they may be an alternative to reinforced concrete frame structures. On the other hand 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 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 behavior of AAC masonry buildings

1.2 PROBLEM STATEMENT

The high rise buildings now-a-days are provided with soft storeys for parking purpose. When such bulding is located in the earthquake prone area, can be subjected to heavy lateral forces. Due to the presence of soft storey in a building, the lateral load resisting capacity of building decreases, thereby the stiffness of building decreases. This leads to sudden failure of structure. To increase the lateral strength and stiffness of a structure, AAC BLOCK are introduced in a structure, such that the building can sustain under the seismic loads and decrease the overall cost of building.

1.3 SEISMIS ANALYSIS OF RC FRAMES WITH INFILL WALL

While analyzing multi storey buildings, designers usually neglect the contribution of masonry infill in resisting loads. They consider only dead weight of masonry and analysis is done by bare frame method. It is very common now days to construct multistoryed buildings with open ground storey. Since there is a sudden change in stiffness at first floor level, ground floor columns will attract greater horizontal force and hence they should be designed for a larger force than that obtained using bare frame analysis. As per IS 1893:2002, the columns and beams of the soft storey are to be designed 2.5 times the storey shears and moments calculated under seismic loads

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Masonry infill walls are laterally much stiffer than the RC frames, and therefore, the initial stiffness of the masonry infilled RC frames largely depends upon the stiffness of masonry infill walls. Accordingly, it is quite important to have a reliable method to estimate the stiffness of the MI walls. Investigations showed that, one of the most appropriate ways of analyzing the masonry infilled concrete frames is to use single equivalent diagonal strut.

2. LITERATURE REVIEW

Dr. B G Naresh kumar and at all (2013)(1) in this experimental study the feasibility of using aerated concrete block as an alternative to the conventional masonry units has been investigated. The preliminary studies focused on the estimating physical, strength and elastic properties of light weight concrete blocks i.e. Autoclaved aerated concrete blocks(AAC). These include initial rate of absorption, density test, water absorption test etc. The compressive strength, modulus of elasticity and the flexural strength of the units were obtained.

Prakash T M and at all (2013)(2) investigated the feasibility of using lightweight concrete block as an alternative to the conventional masonry units. The preliminary studies focused on estimating physical and elastic properties of cellular lightweight block units. These included initial rate of absorption, density test, water absorption test etc. The compressive strength, stress-strain characteristics and the flexural strength of the units were obtained. And the results are comparing with that of conventional masonry units.

Ali J. Hamad (2014)(3) this paper is attention to classified of aerated lightweight concrete into foamed concrete and autoclaved concrete. The literature review of aerated lightweight concrete on material production, properties and its applications. The aerated lightweight properties are focuses on the porosity, permeability, compressive strength and splitting strength. It 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. Aerated concrete is consider economy in materials and consumptions of by-product and wastes materials such as fly ash.

K.Krishna Bhavani Siram (2012)(4) made an attempt to compare CLC blocks and Clay bricks and recommend a replacement material to red bricks in construction industry. Burnt clay Brick is the predominant construction material in the country . The CO2 emissions in the brick manufacture process have been acknowledged as a significant factor to global warning and also focus on the environment solution for greener environment because red bricks requires high energy to burn in kiln to produce it. This study has also shown that the use of fly ash in foamed concrete, can improve the properties of CLC blocks.

Alim Shaikh (2013)(5) Brick is the most commonly used building material in construction. AAC blocks are new construction material which is very light in weight. Compare to same size of (200mm x 100mm x 100mm,its 3 times lighter than traditional brick (clay brick);it means it covers more area in same weight as clay brick gives in one bricks. In this paper; attempt has been made to replace the clay brick with light weight AAC blocks. The usage of AAC block reduces the cost of construction up-to 25% as reduction of dead load of wall on beam makes it comparatively lighter members. The use of AAC block also reduces the requirement of materials such as cement and sand up-to 55%.

Riyaz Sameer Shah (2016)(6) This paper presents the economics of autoclave aerated concrete vis-à-vis conventional brick. This project includes the analysis, design and estimates of structure, comparing between autoclave aerated concrete and conventional brick in the form of steel consumptions. Autoclaved Aerated Concrete (AAC) is a lightweight concrete building material cut into masonry blocks or formed larger planks and panels. Currently it has not seen widespread use in the United States. However, in other parts of the world it use has been used successfully as a building material. In this work we are comparing reinforced concrete design using autoclave aerated concrete and conventional brick as a construction material, as 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. Keywords:. Autoclaved aerated concrete (AAC), lightweight, conventional brick, reinforced steel, save and reduce.

Nagesh. Mustapure and At all (2014)(7) made an attempt to study on cellular lightweight concrete blocks, and following experiment has done to check the properties of CLC blocks of Grade B, such as compressive strength, water absorption, thermal conductivity of CLC blocks for 800 kg/m3, 900 kg/m3, 1000 kg/m3, 1100 kg/m3. The excellent insulating property of foam concrete is due to the great number of closed cavities forming the multi-cellular structure And the study shows that CLC blocks may be used for construction purpose, which is advantageous in terms of general construction properties as well as eco-friendliness.

P.S. Bhandari and and at all (2014)(8) investigated the performance of cellular lightweight concrete in terms of density and compressive strength. The Compressive strength for cellular lightweight concrete is low for lower density mixture. The compressive strength also decreases with the increment of voids. Compressive strength of 53 grade cement is slightly higher than 43 grade cement , but as strength increases its density also increases. Cellular lightweight concrete is acceptable for framed structure. Cellular lightweight concrete can be suitable for earthquake areas.

2.1 RESULTS AND DISCUSSIONS

Some of the papers studies about The dynamic seismic earthquake behaviour of the two types of infill's material as AAC block & Conventional bricks was investigated. The performance of AAC block infill was superior to that of Conventional brick infill in RC frame. Therefore, The AAC block material can basically be used to replace conventional bricks as infill material for RC frames built in the earthquake prone region.The results shows that, the minimum cost of building and maximum strength of AAC brick wall in a building can helps to reduce the deflection and storey drift in a building. Some studies deals with the evaluation of steel and cost of building required for the building provided with AAC BLOCK masonry wall.The seismic analysis for all the RC frame models which consist of full infill (modelling infill as a strut element) (M-1), full infill with soft ground storey (M-2). Model with infill ground storey has been done for two infill materials i.e. for brick masonry infill, AAC block masonry infill by using software ETABS and the results are presented below. The parameters which are to be studied are Base Shear, Displacement, Beam Forces, Column Forces, Storey Shear and Storey drift by changing the material of infill as Brick infill and AAC block infill. Hence The Comparison of displacement between brick infilled frame, AAC block masonry in filled frame and hollow concrete blocks in-filled frame: The effect of infill materials on the lateral displacement is analysed for Brick masonry infill, AAC block masonry infill and hollow concrete block masonry

2.2. CONCLUSIONS

This work is a small attempt towards the understanding of the effect of AAC infill masonry and brick infill masonry on the seismic behaviour of RC

structures. In this work, the seismic behaviour of brick infill panels and AAC in-filled panel was studied and compared in a systematic manner. The main conclusions are summarized below:-

In column, considering AAC infill wall effect, the value of axial force, bending moment, Ast is less compared to brick infill frame. Because of infill wall effect, there is drastic decrease in the value of axial force in column. Maximum Axial Force is at the foundation level.

It has been observed that the base shear, lateral forces and story shear for a structure with AAC blocks is significantly less as compared with the structure in-filled with brick masonry due to low weight density of AAC blocks. Lesser base shear will result in lesser lateral forces and as the weight density of AAC blocks is less as compare with brick masonry the dead load of AAC block masonry is less as compared brick masonry and hence economy in design can be achieved by replacing brick masonry with AAC block masonry.

The response of a structure in terms of bending moments is greatly improved in an infill model. The bending moments is reduced greatly by the introduction of infill panels. The bending moments for members of structure with AAC block in all cases were less as compared with corresponding cases of structure with brick masonry.

Therefore the corresponding benefits of construction cost is lower than conventional bricks material in RC frame structure.

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