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Comparative Analysis of Multi-Storey RCC Building with AAC Blocks and Conventional Blocks

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Abstract - *The increases an 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. Cost of construction is reduced and it will be safe and economical in earthquake forces also. The seismic Parameter Lateral displacements are also compared.*

Key Words: AAC block, Conventional blocks, E-Tab software, diagonal strut, infill wall with opening.

1. INTRODUCTION

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, and 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%.

So, this paper mainly deals with the comparative analysis of the results obtained from the analysis of a multi storied building structure when analyzed manually and using ETABS software. The effective design and construction of earthquake resistant structures have great importance all over the world. This project presents multi-storeyed residential building analyzed 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. 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

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 is 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 multistoried 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.

2. LITERATURE REVIEW

1) P.S. Bhandari and and at all (2014).

Investigate 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) Alim Shaikh (2013)

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%.

3) Riyaz Sameer Shah (2016).

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.

4) Nagesh. Mustapure and at all (2014).

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.

3. OBJECTIVES OF THE STUDY

- To reduce the stiffening effect of infill frame.
- To reduce the cost of construction.
- Usage reduces overall dead load of a building, thereby allowing construction of a taller building.

4. Modeling of Building on Etab

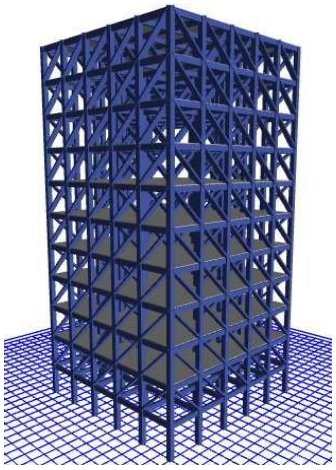


Fig. 3D Render view

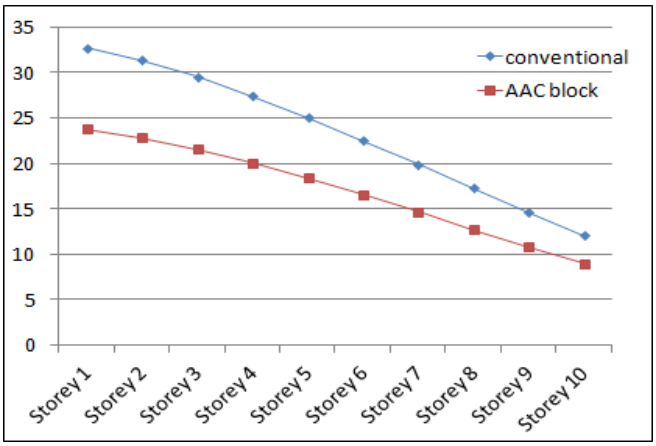
Model 2: RCC building with AAC block as infill material (plan of AAC block)

ETABS SOFTWARE:- *The innovative and revolutionary new **ETABS** is the ultimate integrated **software** package for the structural analysis and design of buildings. ... From the start of design conception through the production of schematic drawings, **ETABS** integrates every aspect of the engineering design process.*

5. METHOLOGY

The RC Framed structure is modeled by using ETABS software for the following cases.

Graph: story's wise of lateral displacement.



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 story 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.

6. CONCLUSIONS

This work is a small attempt towards the understanding of the effect of AAC infill masonry and brick infill masonry on the seismic behavior of RC structures. In this work, the seismic behavior 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. 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 are lower than conventional bricks material in RC frame structure.

Area of footing there is 24.3% of saving n footings there is 24.3% savings while using AAC blocks over clay bricks.

This was the only savings which we could clearly see but while using AAC blocks over clay bricks, more savings would be seen in per unit rate of AAC blocks and very less use of plastering and mortar while brickwork, as compared to Clay Bricks . AAC blocks proved to be the best constructional material.

7. REFERENCES

[1] D. Kornack and P. Rakic, "Cell Proliferation without Neurogenesis in Adult Primate Neocortex," Science

[2] Hemant B. Kaushik; Durgesh C. Rai; and Sudhir K. Jain, " A rotational approach to analytical modeling of masonry infills in reinforced concrete frame buildings" The 14th World Conference on Earthquake Engineering October 12-17, 2008, Beijing, China.

[3] IS: 6041-1985, "Code of practice for AAC block masonry", Bureau of Indian Standard, New Delhi.

[4] Rahul P. Rathi , Dr. P.S. Pajgade "Study of Masonry Infilled R.C. Frame With & Without Opening" International Journal of Scientific & Engineering Research Volume 3, Issue 6, June-2012 1 ISSN 2229-551