ANALYSIS OF COST - EFFECTIVENESS OF EMPLOYING AAC BLOCK AND CLAY RED BRICK FOR CONSTRUCTION ON RCC MULTISTORY BUILDING

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Abstract:
Red bricks are a widely used building material. The carbon dioxide emissions from brick making have been identified as a contributing contributor to global warming. To achieve a better world, we must prioritize environmental solutions. This goal can be achieved by using modern building materials. AAC blocks are one such material that may be utilized as an alternative to traditional building. This research presents a comparative statistical analysis of the economic effectiveness of employing AAC blocks rather than typical red bricks. The usage of AAC blocks provides an ultimate answer for the construction industry's environmental challenges.

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Introduction:

The growth in population causes a land deficit, and high-rise structures are used to compensate. Natural disasters have an impact on these high-rise buildings. Earthquakes are the most hazardous natural disasters. Because of the destruction and confusion caused to the structural components, they are uncontrollable. These natural disasters caused property damage and disruptions in development of the regular lifespan. Because it is a worldwide issue, the majority of the analysis should be completed and the results delivered in order to prepare the structure in order to meet the deadline. With technical growth, man attempted to resist these natural tragedies in a variety of methods, such as building early warning systems for disasters, implementing new preventative measures, and implementing adequate relief and rescue procedures. However, this is not true for all natural calamities. Hazard maps depicting seismic zones in seismic codes (IS 1893:2016) are amended on a regular basis, resulting in increased base shear requirement on older buildings.

We adopted equivalent static method for linear analysis. There are two types of dynamic analysis namely; time-history (TH) analysis and RS analysis methods can be used to make the structures sound against seismic activity where we adopted response spectrum method.

In today’s world, we have old data and new technology, there are several methods in this earthquake resistant building design that we can take benefit of such as computer programs and experience from past earthquakes. In order to achieve a building that is resistant to seismic waves we must put its structural format into consideration for the sake of a better seismic resistance it is important that the form of the building should be simple and distribution of volumes, mass, stiffness should be symmetrical, design for a complicated or irregular form should be avoided because it will cause additional stress in the region of discontinuity. The materials used should also have adequate strength and ductility for the applied seismic actions. Because the ductility gives the structure a feature to be able to absorb some of the energy during an earthquake. When it comes to site selection you have to know where you are going to build the structure and you should be aware of the seismic zoning (active faults, sloping soil profiles, liquefaction) these should be carefully evaluated. During the vibration some parts of the building separate and vibrate independently and are connected to the other parts by seismic joints. All the floor structures should be designed in a way that could act as a diaphragm to send the waves and the loads to the vertical parts of the building. This report focuses on multi-story building that is made with a concrete structure, due to the majority of the structures in India is made of concrete. A custom building is analyzed, then the by the result the structure of the building is designed which includes the size of the slabs, beams, and columns. This project attempts to design a multi-storey building that can resist a high seismic wave and is also economical.

Structural analysis is mainly concerned with finding out the behavior of a structure when subjected to some action. This action can be in the form of load due to weight of things such as people, furniture, wind snow etc. or some other kind of excitation such as earthquake, shaking of the ground due to a blast nearby, etc. In essence all these loads are dynamic including the self-weight of the structure because at some point in time these loads were not there. The distinction is made between the dynamic and static analysis on the basis of whether the applied action has enough acceleration in comparison to the structure's natural frequency. If a load is applied sufficiently slowly, the inertia forces (Newton’s second law of motion) can be ignored and the analysis can be simplified as static analysis. Structural dynamics, therefore, is a type of structural analysis which covers the behavior of structures subjected to dynamic (actions having high acceleration) loading. Dynamic loads include people, wind, waves, traffic, earthquake, and blasts. Any structure can be subjected to dynamic loading. Dynamic analysis can be used to find dynamic displacements, time history, and modal analysis.

Literature Review

1.Ali Kadhim Sallal (2018):

The primary goal of this program is to design and analyze multi-story buildings in a methodical manner. This paper presents a building that was planned and studied using the ETABS program under the effects of earthquake and wind pressure. ETABS software is used to model the (18m x 18m) and eight-story structure in this scenario. The height of the tenth story is regarded as (3m), making the overall height of the construction (31m).

2.Pushkar Rathod and Rahul Chandrashekar (2017):

The building may be planned and built using seismic analysis to resist the high lateral displacement of the earth's crust during an earthquake. ETABS can analyze any form of basic or sophisticated structure under static or dynamic settings. ETABS is a coordinated and productive tool for analysis and design, with applications ranging from simple 2D frames to sophisticated high-rises, making it one of the finest structural software for building systems.

3.Pardeshi Sameer and Prof. N. G. Gore (2016):
This research investigates the impact of various vertical abnormalities on a structure's seismic response. The project's goal is to perform Response Spectrum Analysis (RSA) of regular and irregular RC building frames, Time History Analysis (THA) of regular RC building frames, and ductility-based design utilizing IS 13920, which corresponds to response spectrum analysis. The findings of the study of irregular structures are compared to the results of the analysis of regular structures.

4.Vijaya Bhaskar reddy. S et. al. (2015):
This article illustrates a comparison analysis of static loads for 5 and 10 story multi-story constructions. The purpose of this task is to estimate a structure's design loads. They infer that as the number of floors increases, so does the deflection of the members. The axial force in a 10-story structure is higher than in a 5-story building.
5. Sylviya.B et al. (2018) have conducted comparative research on the efficient placing of shear walls in different seismic zones for an RCC multi-story building. Four models were created for the investigation, and characteristics such as story drift, displacement, and shear were discovered in all four zones (Zones II, III, IV, and V). It has been determined that shear walls are most effective when positioned near the building's extremities, and that story drift and displacement are greatest in zone V.

6. Tarun Magendra et al.(2016)
The optimal location of shear walls in multi-story structures was investigated in this research.
It has been discovered that shear walls positioned in the center or at the corners of the building's design, forming a box, signify that the structure is more stable for characteristics such as story displacement and story drift, and overturning moments are minimal in traditional structures.

7. Sana Fatema et.al (2016)
They have published a journal on "Progressive Collapse of Reinforced Concrete" in International Journal of Emerging Trends in Science and Technology using ETABS software for evaluation of Progressive collapse linear static method and nonlinear static method of analysis and they have concluded that shear in beam is not critical in any case, Columns are also not critical in Progressive collapse. However, linear static and nonlinear static research revealed that beams will break in flexure.

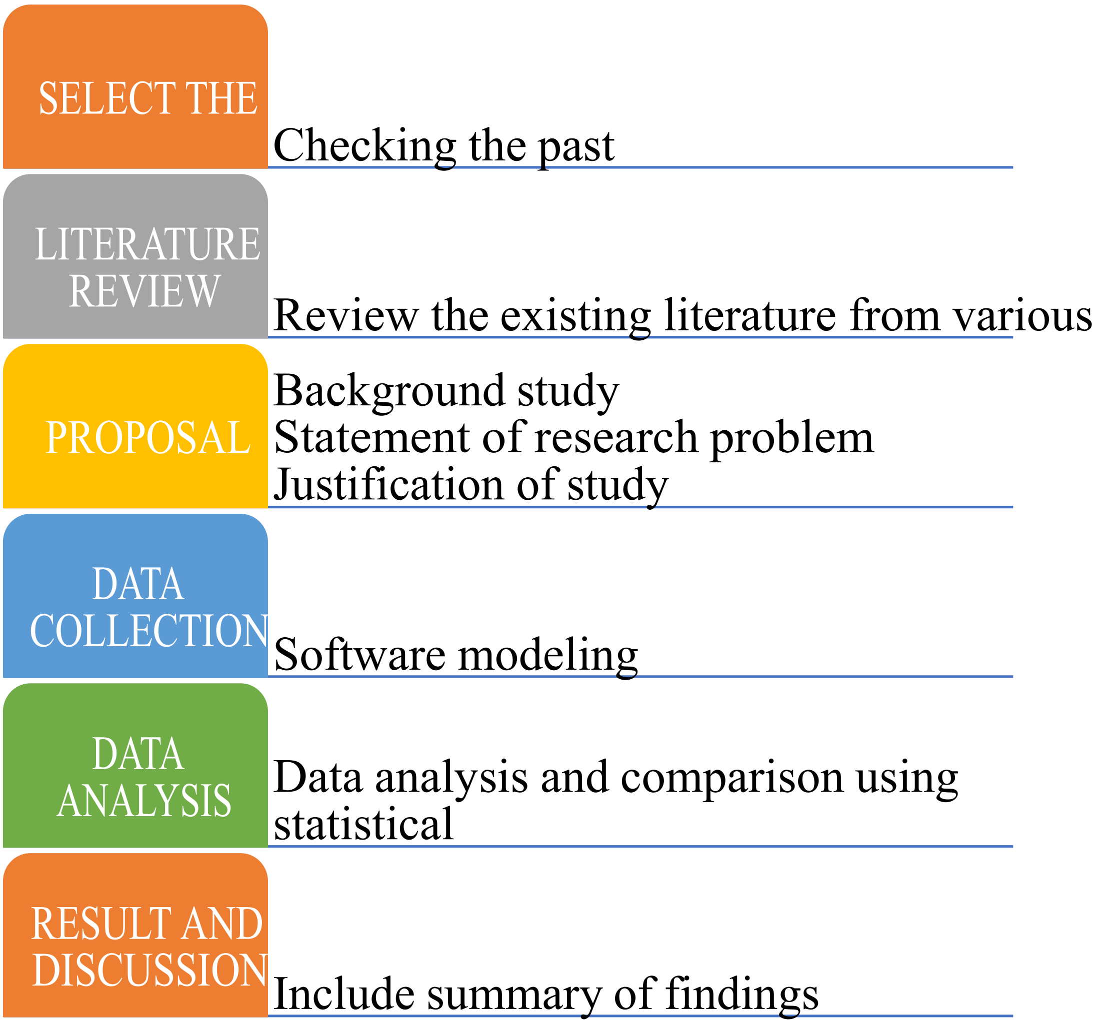
8. GirumMindaye et.al (2016)
The International Journal of Innovative Research in Science, Engineering, and Technology (IJIRSET) has published a journal on "Seismic Analysis of a Multistory RC Frame Building in Different Seismic Zones," which compares the story stiffness, base shear, lateral force, story shear, story displacement, overturning moments, and story drift statically and dynamically for different Zones cases.

9. B. Srikanth and V. Ramesh (2013)
A comparison of seismic response algorithms for seismic coefficient and response spectrum. The seismic reaction of a symmetric multi-story building is investigated using two methodologies in this thesis. The approaches include the IS Code-recommended seismic coefficient method and modal analysis utilizing the IS Code-recommended response spectrum method, in which the stiffness matrix of the building corresponding to the dynamic degrees of freedom is constructed by idealizing the building as a shear building. The results achieved by the foregoing procedures in two extreme zones as defined by the IS code, zones II and V, are then compared. Base shears, lateral forces, and story moments are compared as test results.

Methodology

General

This thesis examines the modeling, planning, and analysis of multi-story buildings utilizing a variety of software programs. AutoCAD software is used to design the building plan, section, and elevation, while the EATBS program is used to model the building. In the ETAB program, the complete structure is constructed and examined for various sorts of loads. Various models were developed to examine the seismic effect on high-rise structures, and then various techniques/alternatives were studied to reduce seismic pressures.



Technology and Method

Building Descrip on

ETABS models of G+10, G+20, and G+30 storey structures with varied seismic settings were produced. We evaluated the impact of AAC infill masonry and brick infill masonry on seismic behavior by studying the base shear of RC structures in the ETAB model. The building is near to be square in plan with dimensions 58.49m x 17.6m. The building is designed for residential use. Typical floors plan and isometric view are presented below. Typical floor height is 2.95m. The floors are made of concrete slabs supported by columns/shear wall. The thickness of the floor slab is 125mm, 150mm for all story. The designed system to resist the seismic forces consists of two elevator cores in both X and Y direction. Additional shear wall in X and Y direction is also designed for seismic resistance purpose. The considered here in building structure has been designed according to the EC with specified characteristic compressive strength fcu = 25 MPa and steel reinforcement with yield strength fy= 360 MPa.

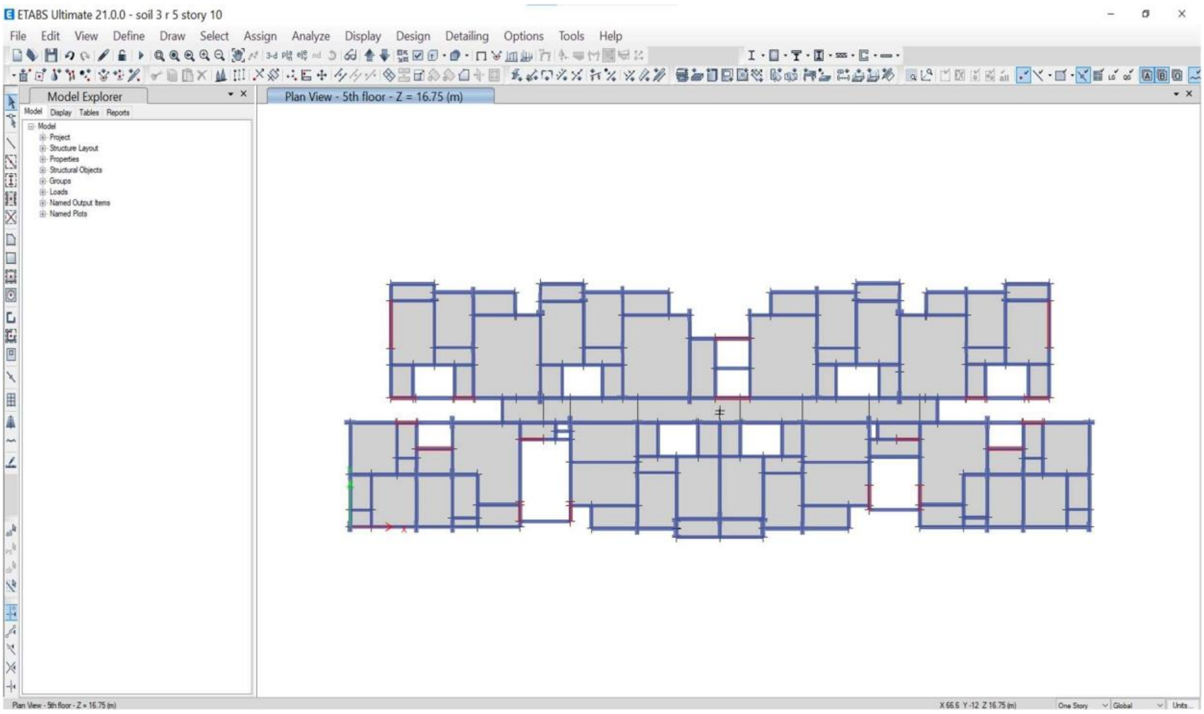


FIGURE4. 1TYPICAL FLOOR PLAN

Building Model

The three-dimensional Multistorey building used in this study was modelled as slab-column system with shear walls. For the purpose of modelling the real behavior of the building, they were modelled using shell elements to ensure providing stiffness in all directions and transfer mass of slab to columns and beams. A rigid diaphragm was assumed at all floor levels. In order to account for the modal damping effect, the complete quadratic combination (CQC) technique, which takes into account the statistical coupling between closely spaced modes caused by modal damping, is used for modal combination. The first modelling step with ETABS involves defining the physical properties of the used materials. Sections for horizontal and vertical elements of the considered building are defined in terms of dimensions and material properties. Consequently, the defined sections are assigned to the corresponding plane elements such as slabs and beams and the corresponding vertical elements such as columns and shear walls. Choosing the correct boundary conditions through assigning supports and connections with appropriate restraints is one of the important aspects in structural modelling. Three-dimensional analysis is carried out under static and dynamic seismic analysis in both X and Y directions, which are known to be orthogonal directions.

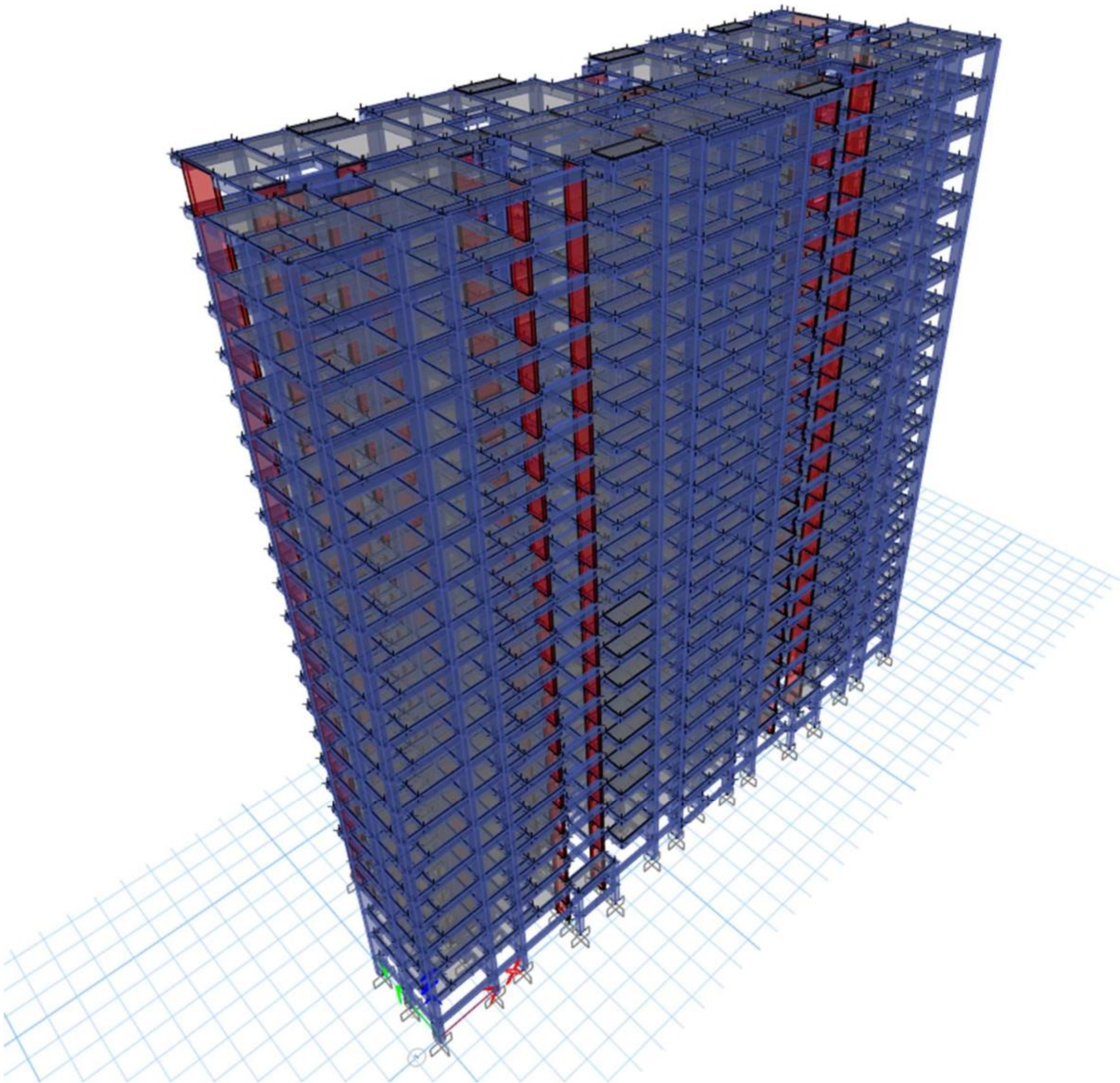


FIGURE4. 2THREE-DIMENSIONAL BUILDING MODEL

Modeling And Analysis

Earthquake Analysis Methods

Most of the used design codes provide the minimum standards required life safety but not to insure preventing damage. There are two commonly used procedures for specifying seismic design forces namely: the linear method equivalent static method and Nonlinear response spectrum method.

For the analysis of multi storied building following dimensions are considered which are elaborated below.

Equivalent Sta c Force Method

In this method the inertia forces are determined as static force with the use of empirical formulas. To adequately represent the dynamic behavior of the structures, the method is highly recommended for regular structures with uniform distribution of mass and stiffness as well as uniform shape and statical system, . However, it can be applied to irregular ones with some limitations. The design base shear can be calculated as:

$$F_b = S_d (T) \lambda W/g \quad (1)$$

Where, T represents the fundamental time period of the structure, λ is a correction factor, dependent on the fundamental period of the structure with respect to the value of T_C, W is the structure's weight. Additionally, the seismic zone factor affects the value of the induced base shear. The formulas used to calculate the previously defined terms can be found in the design codes for loads. The use of the method requires defining parameters such as seismic zone factor, soil profile and seismic source type which can be calculated in accordance with the principals of the regulations used in this study. The base shear F_b, as determined from Eq. (1) is distributed over the height of the structure as a force Fi at each level in addition to a force F_t at the top of the structure according to the formula:

$$F_b = F_t + \sum_{i=1}^{n} F_i \qquad (2)$$

The extra force F_t 07TF_b and no more than 0.25 F_b only when T > 0.7 sec.
The remaining portion of the total base shear (F_b - F_t) is distributed over the height, including the top, by the formula:

$$F_i = \frac{(F_b - F_t)(w_i h_i)}{\sum_{i=1}^{n} w_i h_i} \qquad (3)$$

Where, w_i and h_i respectively refer to the floor's weight and floor's height at the i th level above the building's base. The point of action of the calculated story force is acting at the story center of mass. The overturning moment M at a particular story level i is the sum of the moments of the story forces above, about that level. Hence:

$$M_i = F_t(h_n - h_i) + \sum_{j=i}^{n} F_j\left(h_j - h_i\right) \qquad (4)$$

The accidental torsional moment shall be determined through dividing the maximum displacement δ_{max} at level i by the average displacement δ_{avg} and torsional irregularity exists if the obtained ratio exceeds 1.2. The effect of torsional irregularity at a specified story shall be accounted for by increasing the accidental torsion at the specified level by an amplification factor, A_x determined from the following formula:

$$A_x = \left[\frac{\delta_{max}}{1.2\delta_{avg}}\right]^2 \leq 3 \qquad (5)$$

Response Spectrum Analysis Method
Response spectrum analysis is used for analyzing the performance of structures under earthquake motions. The method assumes a single degree of freedom system to be excited by a ground motion in order to obtain the response spectrum curves for peak displacement, peak velocity or peak acceleration. Thus, once the natural period of the structure is known then the response spectrum curves help in estimating the peak responses of such structure. These estimated values are considered as the basis for calculating the earthquake forces to be resisted through earthquake resistant design stages. In order to perform RS analysis, important parameters in terms of expected earthquake intensity in the considered zone and the supporting base soil behavior have to be considered. One of the other parameters related to the computation process is the modal analysis in which the RS analysis computes the structure's response through considering the significant modes. Mode contribution to the structure's response and flexural deformation is mainly dependent on the structure's height. For low to mid-rise structures, the first three modes are sufficient to capture accurate results where the higher modes contributions diminish very quickly. However, more than three modes have to be considered for high-rise structures. These numbers of requested modes can be selected such that their combined participating mass is at least of 90% of the total effective mass in the structure. Once the number of significant modes is established, several methods are used for the purpose of estimating the peak response values. The Square Root of Some of Squares (SRSS) of the maximum modal values is one of the popular methods. Another two methods namely: sum of the absolute of the modal response values (ABS) and the CQC are also used for peak response computation. Scaling the response spectrum curve to consider the over strength and global ductility capacity of lateral force-resisting systems is another important parameter during dynamic RS analysis. Rescaling the design base shear in accordance with the ones obtained with the ESF analysis is another important parameter. The regularity and irregularity of structures mainly govern the scaling factor of the design base shear. The design building codes in seismic regions uses the obtained pseudo acceleration values $S_d(T)$ as basis for calculating the forces that a structure must be designed to resist.

Sta c and Dynamic Parameters: -
Design Parameters- Here the Analysis is being done for G+10, G+20 and G+30 (rigid joint regular frame) building by computer software using ETAB.

Design Characteris cs: -
The following design characteristics are considered for Multistory rigid jointed plane frames

TABLE4. 1TABLE 1 DESIGN DATA OF RCC FRAME STRUCTURES G+10

S.No	Particulars	Dimension/Size/Value
1.	Model	G+10
2.	Seismic Zones	IV
3.	Floor height	2.95M

4.	Depth of foundation	2M
5.	Building height	34.45M
6.	Plan size	58.49Mx17.6M
7.	Total area	1029.424Sq.m
8	Walls	(a)External-0.230M
		(b)Internal-0.125M
9	Thickness of slab	125mm ,150mm
10	Earthquake load	As per IS-1893-2016
11	Type of soil	Type -I, II, III Medium soil as per IS-1893
12	Ec	5000√fck N/ mm2(Ec is short term static modulus of elasticity in N/ mm2)
13	Fck	0.7√fc k N/ mm2(Fck is characteristic cube strength of concrete in N/ mm2
14	Live load	2kN/ m2
15	Floor finish	1.1kN/ m2, 2.2kN/ m2
16	Water proofing	2.500kN/ m2
17	Specific wt. of RCC	25.00 kN/ m2
18	Specific wt of infill	20.00 kN/ m2
19.	Material used	Concrete M-30and Reinforcement Fe-500(HYSD Confirming to IS1786)
20	Reinforcement used	High strength deformed steel Confirming to IS-786. It is having modulus of Elasticity as 2 00 kN/ mm2
21	Static analysis	Equivalent static lateral force method.
22	Dynamic analysis	Using Response spectrum method
23	Software used	ETAB for both static and dynamic analysis
24	Specified characteristic	compressive strength of 150mm cube at 28 days for M-30 grade concrete - 30N/ mm^2
25	Fundamental natural period of building	Ta = 0.075 h0.75 for moment resisting RC frame building without infill's Ta = 0 .09 h /√d for all other building i/c moment resisting RC frame building with brick infill walls Where h = height of building d = base dimension of building at plinth level in m along the considered direction of lateral forces .
		As per Is-1893-2016 Part -1 for different. Zone as per clause 6.4.2.
26	Zone factor Z	

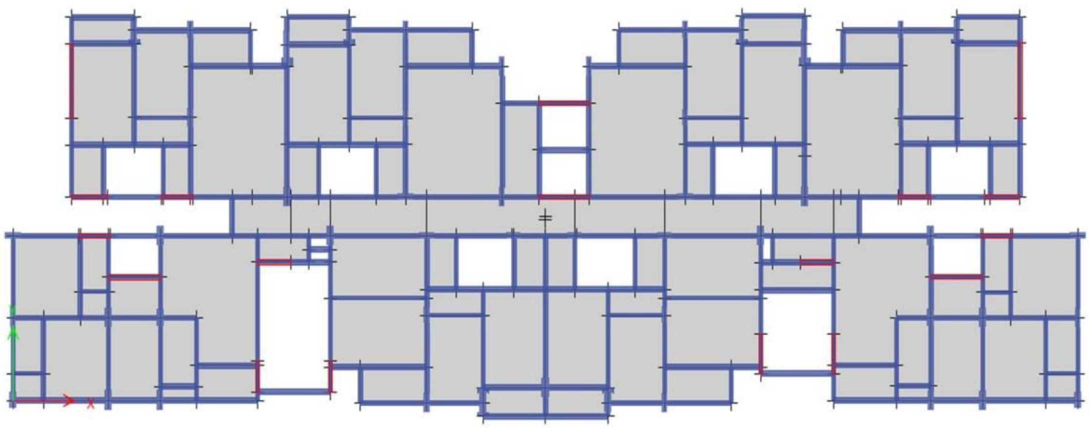


FIGURE4. 3PLAN

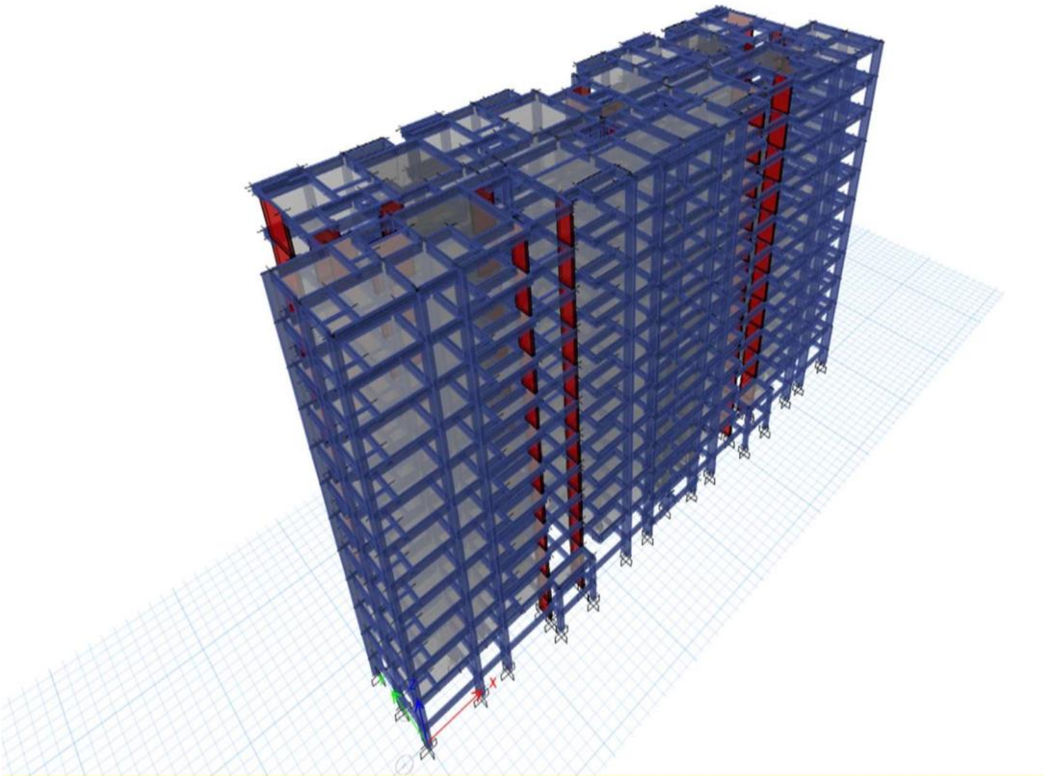


FIGURE4. 43D VIEW

TABLE4. 2TABLE 2 DESIGN DATA OF RCC FRAME STRUCTURES G+20

S.No	Particulars	Dimension/Size/Value
1.	Model	G+20
2.	Seismic Zones	IV
3.	Floor height	2.95M
4.	Depth of foundation	2M
5.	Building height	63.95M
6.	Plan size	58.49Mx17.6M
7.	Total area	1029.424Sq.m
8	Walls	(a)External-0.250M
		(b)Internal-0.125M
9	Thickness of slab	125mm, 150mm
10	Earthquake load	As per IS-1893-2002
11	Type of soil	Type -I, II, III Medium soil as per IS-1893
12	Ec	5000√fck N/ mm2(Ec is short term static modulus of elasticity in N/ mm2)
13	Fck	0.7√fc k N/ mm2(Fck is characteristic cube strength of concrete in N/ mm2
14	Live load	2kN/ m2
15	Floor finish	1.1kN/ m2, 2.2kN/ m2
16	Water proofing	2.500kN/ m2
17	Specific wt. of RCC	25.00 kN/ m2
18	Specific wt of infill	20.00 kN/ m2
19	Material used	Concrete M-30and Reinforcement Fe-415(HYSD Confirming to IS1786)
20	Reinforcement used	High strength deformed steel Confirming to IS-786. It is having modulus of Elasticity as 2 00kN/ mm2
23.	Static analysis	Equivalent static lateral force method.
24.	Dynamic analysis	Using Response spectrum method
25.	Software used	ETAB for both static and dynamic analysis
26.	Specified characteristic	compressive strength of 150mm cube at 28 days for M-30 grade concrete - 30N/ mm^2
27.	Fundamental natural period of building	Ta = 0.075 h0.75 for moment resisting RC frame building without infill's Ta = 0 .09 h /√d for all other building i/c moment resisting RC frame building with brick infill walls Where h = height of building d = base dimension of building at plinth level in m along the considered direction of lateral forces.
		As per Is-1893-2016 Part -1 for different. Zone as per clause 6.4.2.
28.	Zone factor Z	

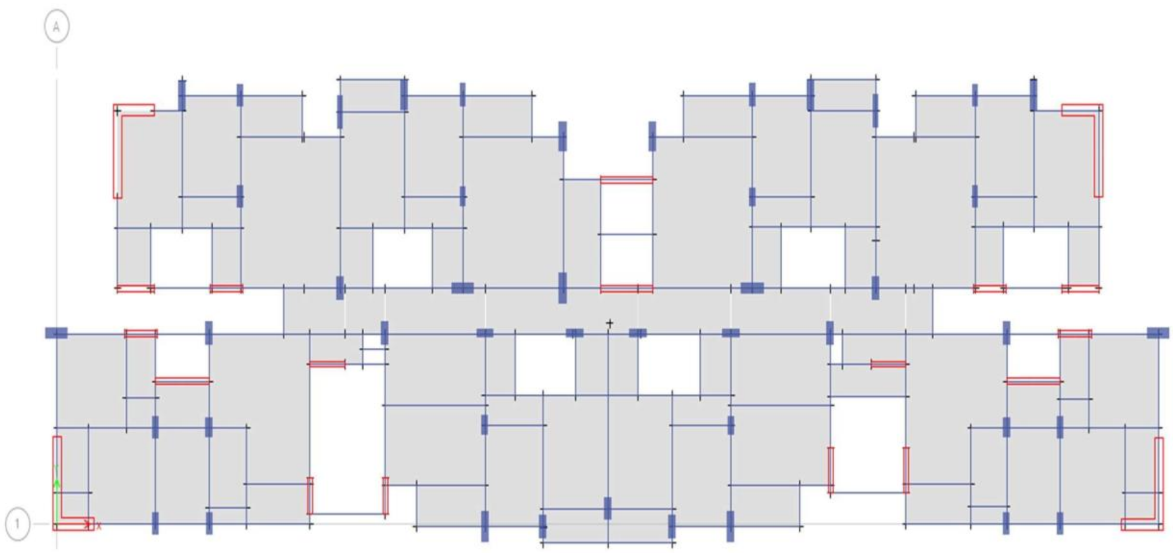


FIGURE4. 5 PLAN

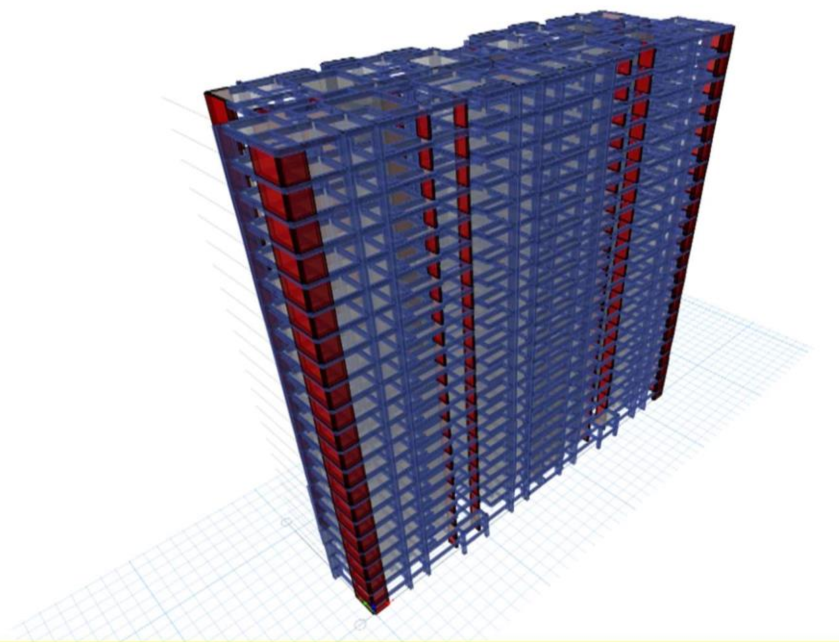


FIGURE4. 63D VIEW

TABLE4. 3TABLE3 DESIGN DATA OF RCC FRAME STRUCTURES G+30

S.No	Particulars	Dimension/Size/Value
1.	Model	G+30
2.	Seismic Zones	IV
3.	Floor height	2.95M
4.	Depth of foundation	2M
5.	Building height	63.95M
6.	Plan size	58.49Mx17.6M
7.	Total area	1029.424Sq.m
8	Walls	(a)External-0.250M

		(b)Internal-0.125M
9	Thickness of slab	125mm, 150mm
10	Earthquake load	As per IS-1893-2002
11	Type of soil	Type -I, II, III Medium soil as per IS-1893
12.	Ec	5000√fck N/ mm2(Ec is short term static modulus of elasticity in N/ mm2)
13	Fck	0.7√fc k N/ mm2(Fck is characteristic cube strength of concrete in N/ mm2
14	Live load	2kN/ m2
15	Floor finish	2.5kN/ m2
16	Water proofing	2.500kN/ m2
17	Specific wt. of RCC	25.00 kN/ m2
18	Specific wt of infill	20.00 kN/ m2
19	Material used	Concrete M-30and Reinforcement Fe-415(HYSD Confirming to IS1786)
20	Reinforcement used	High strength deformed steel Confirming to IS-786. It is having modulus of Elasticity as 2 00 kN/ mm2
21	Static analysis	Equivalent static lateral force method.
22	Dynamic analysis	Using Response spectrum method
23	Software used	ETAB for both static and dynamic analysis
24	Specified characteristic	compressive strength of 150mm cube at 28 days for M-30 grade concrete - 30N/ mm^2
25	Fundamental natural period of building	Ta = 0.075 h0.75 for moment resisting RC frame building without infill's Ta = 0 .09 h /√d for all other building i/c moment resisting RC frame building with brick infill walls Where h = height of building d = base dimension of building at plinth level in m along the considered direction of lateral forces.
		As per Is-1893-2016 Part -1 for different. Zone as per clause 6.4.2.
26	Zone factor Z	

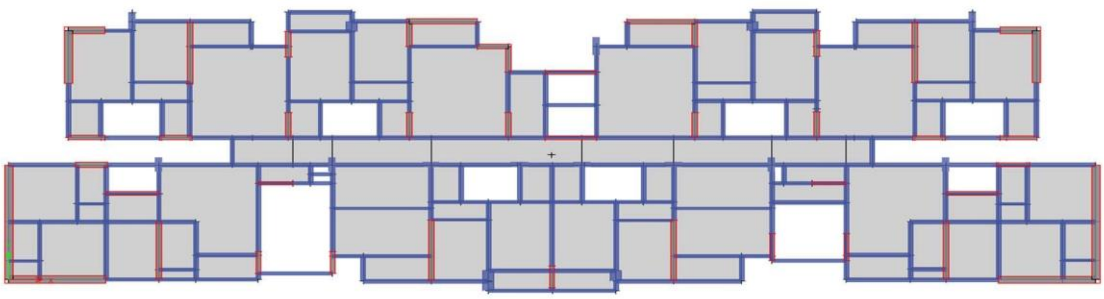


FIGURE4. 7PLAN

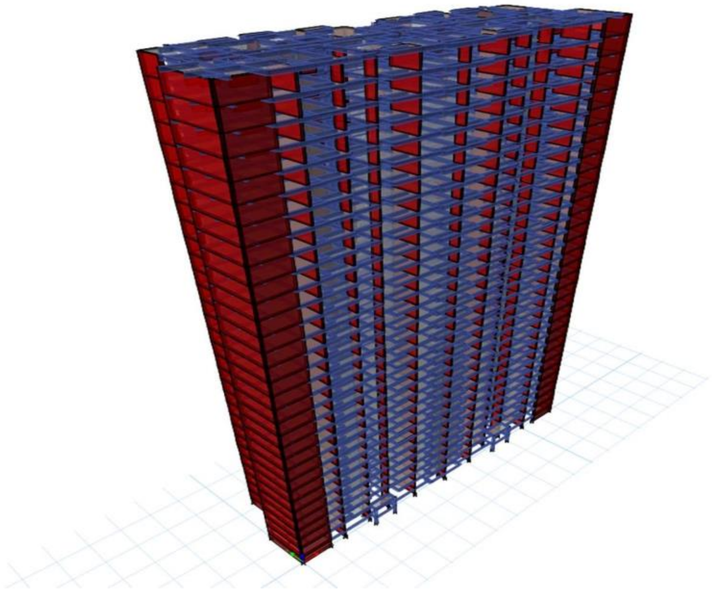


FIGURE4.83D VIEW

Compara ve Analysis of AAC Block, Clay Brick

The comparative analysis of Autoclaved Aerated Concrete (AAC) blocks, red clay bricks.

TABLE4. 4COMPARATIVE ANALYSIS OF AAC BLOCK, CLAY BRICK

S. No	Parameter	AAC Blocks	Clay Red Bricks
1	Raw Materials	Cement, fly ash, water, and Air entraining agents	Locally available clay
2	Size	400-600mm X 200mm X 150mm – 300mm	225mm X 75mm X 100/150mm
3	Variation Size	1.5 mm (+/-)	5 mm (+/-)
4	Compressive Strength (As per IS codes)	3-4 N/mm2	3.5 N/mm2
5	Dry Density (As per IS codes)	550-650 kg/m3 Its one-third of the weight of clay brick which makes it easy to lift and transport	1800 kg/m3
6	Cost-Benefit	For high rise buildings, there will be a reduction of Deadweight which leads to saving in Concrete and steel quantities.	As easily available in the local market hence it is beneficial for low rise structure.
7	Fire Resistance (8″ Wall)	Up to 4 Hours	Around 2 Hours
8	Quality of End Product	Factory-made product. So the quality of the end product is consistent and good	Locally made products. Quality depends on various parameters like quality of raw materials used, the process of manufacture, etc.,
9	Sound Insulation	Better Sound absorption/insulation as compared to bricks	Normal
10	Energy Saving	Low thermal conductivity (0.24 Kw-M/C) helps in saving electricity costs 30% for heating and cooling of the house	High thermal Conductivity (0.81 Kw-M/C). So no significant cost savings
11	Environmental Friendliness	In AAC Block there is no topsoil consumption and it emits very low Carbon dioxide as compared to red clay	One sq ft of carpet area with clay brick walling will consume 25.5 kg of topsoil (approx.). It damages the environment

12	Internal and External Plaster	As these bricks have dimensional accuracy, the internal and external plaster thickness can be reduced	Requires thick plaster surface as there are variations in the dimensions
13	Cost of Construction	1 Cum costs – Rs. 4200/-	1 Cum costs – Rs. 2440/-
14	Joining Process	Chemical mortars can be used for joining the brick. This reduces the material consumption for cement and avoids curing process	The traditional mortar needs to be used and the brickwork should be cured at least for 7 days before plastering
15	Availability	The factory setup cost is high. Not many factories, so availability is a concern.	Available locally in all cities and villages.
16	Thermal Insulator	AAC Blocks are good thermal insulator if cooling is a major component, monthly expenses it will save cost for an entire lifetime	It has low thermal insulation as compared to AAC and CLC Block
17	Tax Contribution	Contributes to Government taxes in form of Central, Excise, and VAT	No Tax Contribution
18	Cylindrical Structures	For Cylindrical structure, these blocks are not much useful	Cylindrical manholes need small size of bricks so that the curvature can be formed hence Red clay bricks are useful
19	Water Absorption	Absorb 12- 15% by the total volume of AAC blocks	Absorb 17 -20% by the total volume of red clay brick
20	Range of Application	They are suitable for non-loadbearing or RCC structure in the partition wall	They are useful in both load-bearing and non-load bearing structure

Cost Compara ve Analysis of AAC Block, Clay Brick.

According to Jain et al. (2018), Table 2 and Table 3 describe the cost comparison study of brickwork in masonry and plaster for AAC blocks, red clay bricks, and Cellular Light Weight Concrete (CLC) blocks.

TABLE4. 5COST COMPARATIVE ANALYSIS FOR AAC BLOCKS AND CLAY BRICK MASONRY FOR 1 M^3 [1:4]

S. No.	Parameters	Clay Red Bricks	AAC Blocks
1	Quantity Analysis	200mmx 100mm x 100mm	600mm x 200mm x 200mm
2	No. of bricks / blocks	500	37
3	Mortar Quantity	0.2766 m3	0.1344 m3
4	No. of begs of cement	1.65	1.0
5	Quantity of Sand	0.221 m3	0.1075 m3
6	Quantity of Water	31 Litres	16 Litres
7	Rate Analysis	5252.00 Rs./ m2 (As per MP PWD SOR building work 2014 clause no.6.3)	5052.00 Rs. / m2 (As per MP PWD SOR building work 2014 clause no.6.27)

TABLE4. 6COST COMPARISON FOR PLASTERWORK FOR AAC BLOCKS AND CLAY BRICK FOR1 M3 [1:4]

S. No.	Parameters	Clay Red Bricks	AAC Blocks
1	The volume of mortar for plaster	1.8 m3	1.0 m3
2	The volume of mortar by 25% for wastage and frog filling	2.25 m3	1.25 m3
3	Quantity of cement	0.45 m3	0.25 m3

4	No. of begs of cement	13.5	7.5
5	Quantity of Sand	1.8 m3	1.0 m3
6	Quantity of Water	236.25 Liters	131.25 Liters
7	Rate Analysis	171.00 Rs./ m2 (As per MP PWD SOR building work 2014 clause no.13.6)	91.10.00 Rs./ m2 (As per MESSOR building work 2010 item no.14001)

Conclusions

The following conclusions on the cost-effectiveness of employing AAC block for building construction are made based on the aforementioned data and debate.

i) For residential buildings, the cost of AAC savings reduces by at least 14.5% as the number of rooms grows, along with built-up area. Similar to how the price of cement savings falls, by roughly 43.27%, as built-up area increases.
ii) For residential buildings, there is a decrease in steel cost as the built-up area grows, with an average% saving in steel cost of roughly 17.9%.
iii) The average cost savings for steel in public buildings is around 14.63%, which is smaller than the savings in residential buildings. This is due to the bigger room sizes and longer beam spans in public buildings, which maximize the need for steel in various RCC parts.
iv) The cost reduction using AAC blocks for various construction types is 14.78%.
v) For various types of constructions, there is a 41.7% reduction in the cost of materials like sand, aggregate, and cement.
vi) As a result of the reduction in the dead weight of the wall on the beam, the cost of steel is reduced by 17.2% for various building types.
vii) The overall construction cost savings for various building types is 20.99%.
viii) Savings per square meter of built-up space for residential buildings average around 0.11%, whereas savings for public buildings average about 0.04%.
ix) When the wall's width is 6 inches thick as opposed to 9 inches thick, the increase in carpet area for various building types is 4.3%.
x) As the dead weight of the wall on the beam is reduced, the cost of construction is reduced by a maximum of 20%.

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