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Comparative Study of Bending Moment Generated in Structure having different Infill Materials using ETABS

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Abstract: Reinforcement concrete structure frame system widely used around the world. In building structure, structure element is generally taken as Beam, column, foundation. The dead & live load is transforming from beam to column, column to footing then ultimately load distributed into the soil. During the analysis of frame structure, we consider wall as non-structural element. But including walls in the structure analysis is play important role. This study deals with the examination of the impact of infill in structure and their behaviour in structure. In present situation high rise building constructed with the various type of infill wall materials. Some of them generally use for example Red brick, AAC wall, Hollow concrete block, lightweight Aluminium & Steel panels. So three types of modal create on ETABS software. In this study 9 storey high rise building is modal in ETABS with taken 3 infill materials like Fly Ash ,AAC block and Hollow concrete block taken for study which on the most critical earthquake zone IV analysis (Dynamic) is done using ETABS, soil properties assumed medium and importance factor is taken 1.2 . The all three infill wall models compare with the basic design parameter like moment, shear force, displacement and as well as earthquake parameter like story drift, story shear etc.

The all three models that I passed under seismic loading helped me to reach the conclusion on how all three models perform in the case of seismic loading. And by comparing the percentage growth in the bending moment we can decide the most efficient building against the dynamic loading. Because the AAC block has the lowest density hence it should have the least moment generated compared to other bricks almost 20-30 percent difference is expected.

Keywords: ETABS, masonry infill, RC frame, earthquake, bending moment, AAC blocks, Hollow concrete block

I. INTRODUCTION

A tall structure is a multi-story structure in which most tenants rely upon lifts [lifts] to arrive at their goals. Now a days due to growth of the population Housing has developed into an economy generating industry. Because of this high rise buildings have become a solution in large cities.

The increasing frequency of the earthquakes in the world and building of tall structures, over the last few 10-20 years forces for the development of tremor safe structures. A considerable lot of the tall structures had fell in ongoing tremors and the reasons credited were poor plan and development rehearses.

The goal of this work is to talk about the potential outcomes of demonstrating support itemizing of strengthened solid models in common sense use considering different type of infill walls. To carry out the analytical investigations, the structure is modelled and analysis is done in ETABS software.

Infill wall**:** The infill wall is the supported wall that works as separator in buildings used to define shape of a room or outer boundary of a building constructed with a three-dimensional framework structure generally made of steel or reinforced concrete. Therefore, the basic edge guarantees the bearing capacity, though the infill divider serves to isolate inward and space, topping off the crates of the external casings.

The walls has one of a kind static capacity to shoulder its very own load. Infill walls are outside vertical misty kind of conclusion. As for different types of separators, the infill-walls contrasts from the parcel that divides two inside spaces. The last plays out similar elements of the infill-wall, hydro-thermally and acoustically, however performs static capacities as well.. The use of masonry infill walls, and to some extent veneer walls, especially in reinforced concrete frame structures, is regular in numerous nations. Indeed, the utilization of stone work infill dividers offers a prudent and tough arrangement. They are anything but difficult to fabricate, appealing for engineering and has a productive cost-execution. They give warm and sound protection. The give imperviousness to fire. They give adequate openings to common ventilation and coating.

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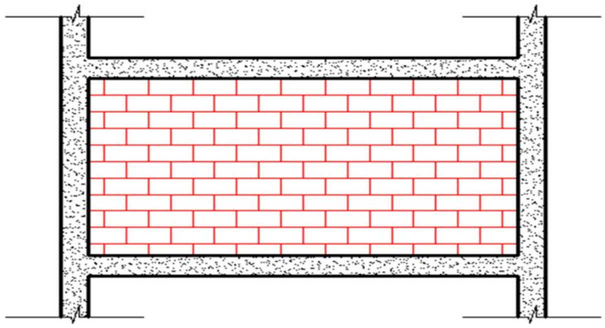

Fig. 1: Infill Wall

Above figure shows a section of Infill wall built between supporting columns and beams.
The main objective of this study is to determine the following:

1) To Determine the Analysis of a Building structure with various types of infill walls
2) To determine performance of building structure with infill walls in zones IV.
3) To analyse the implementation of SRSS Method in tall structure using ETABS.
4) To compare normal conventional building with building with different infill wall building with behaviour in loading and other structure parameter.

Table 1: Material Description

S.NO	Description	Value
1	RED BRICK	Y= 18 KN/m^3
2	AAC BLOCKS	Y= 8 KN/m^3
3	HOLLOW CONCRETE BLOCK	Y= 14 KN/m^3
4	Tensile Strength, Ultimate Steel	500 MPa
5	Young's modulus of steel, Es	$2.17x10^4$ N/mm^2
6	Poisson ratio	0.17
7	GRADE OF CONCRETE	M25

Table 2: Building geometry

S.NO	Description	Value
1	Area	20 X 25 m
2	Number of bays in X direction	4
3	Number of bays in Z direction	5
4	Height of Floors	3.0 m
5	Overall height	33 m

Table 3: Load assignment

S.No.	Load Type	As per I.S.
1	Dead Load	I.S. 875-PART-1
2	Superimposed Load	I.S. 875-PART-2
3	Seismic (dynamic) response reduction	I.S. 1893-PART-1
4	Load Combinations	I.S. 875-PART-5

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In This Present Study We Create 3 Types Of Model

Table 4: Types Of Model Formation In ETABS

Model no.	Type of model formulation in etabs
1.	RCC frame taking with infill wall loading. (calculated value)
2.	RCC frame with assign infill wall properties in etabs.
3.	RCC frame with diagonal strut member method.

II. LOADING CALCULATION

A. Dead Load

1) Wall Load

a) FLY ASH Brick = 0.2X 18X (3-0.5) = 9 KN / m2

b) AAC Block = 0.2 X 8 X (3-0.5) = 4 KN / m2

c) Hollow Concrete = 0.2 X 14 X (3-0.5) = 7 KN / m2

2) Slab Load

0.125 X 25 X 1 +1 = 4.2 KN / m2 (Including floor finish)

B. Live Load

ASSESSABLE AREA – 2 KN / m2

Live Load (Seismic calculation) 25% of Live load: - 0.5 KN/m2

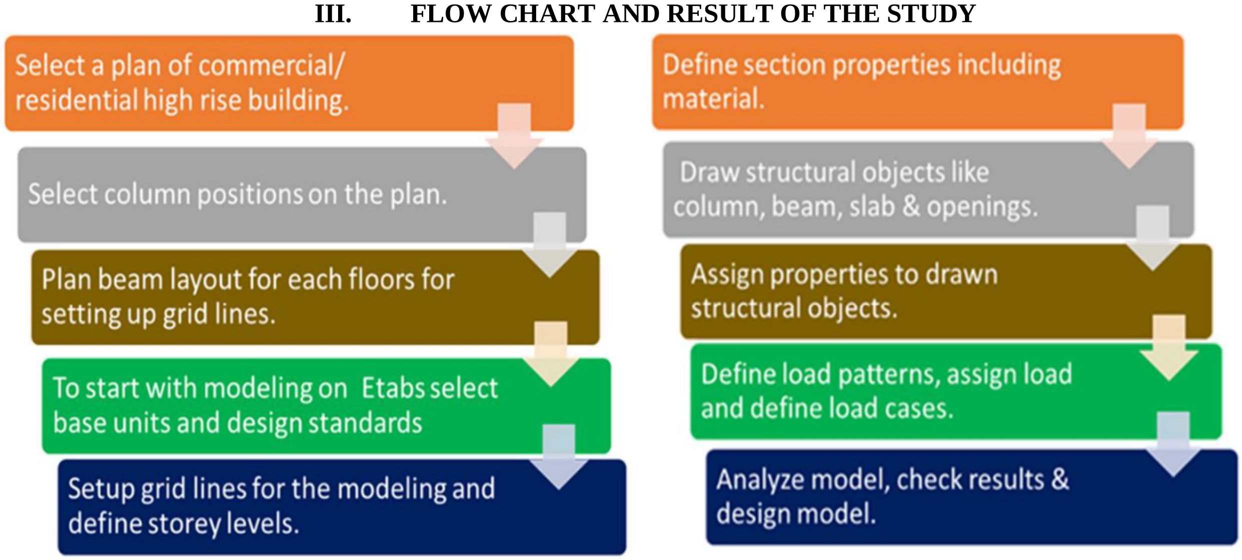
C. Seismic Load

All frames are analyzed for (V) earthquake zone. The seismic load calculation are as per IS: 1893 (part-1)-2016.Seismic force parameters for proposed issue.

Parameter Values using I.S.Code

1) Zone- (V) 0.36
2) Damping ratio- 0.05
3) Importance factor -1.2
4) Response Reduction Factor- 5
5) Soil site factor- MEDUIM SOIL

III. FLOW CHART AND RESULT OF THE STUDY



A. Analysis Result

Following results were observed.

Percentage increase and decrease of bending moment between models,

1) Fly ash bricks, Model 2 has 4% more bending moment than Model 1 and Model 3 has 7% less bending moment than Model 2.
2) AAC bricks, Model 2 has 7.5% more bending moment than Model 1 and Model 3 has 15.7% less bending moment than Model 2.
3) Hollow concrete bricks, Model 2 has 2% more bending moment than Model 1 and Model 3 has 16% less bending moment than Model 2

IV. SUMMARY

A- Following things we can see from the results that the physical properties of the walls has very significant effect in the ability of the structure to handle Lateral loading. The storey displacement was least in AAC block wall in Model 3 with the Diagonal strut in the place of strength and stiffness of the wall material. Storey shear also was seen the lowest in the AAC block walls And the Bending Moment also was seen the lowest in the AAC blocks. Hence we can conclude that the AAC blocks are a better replacement for conventional infill materials in Earthquake prone areas.

B- One more thing that we see from this study that neglecting the structural properties i.e. not considering walls as a structural element is not beneficial as seen from the Model 1 of every case. Models with structural properties of walls performed well in earthquake conditions.

C- Future Scope of this study is that by proving that the Walls too play an important role in the overall stiffness of the structure in the Earthquake conditions we can design structures with keeping that in mind.

D- In future studies will can analyze the different infill walls effect in the irregular building under the seismic loading dynamic analysis.

E- We can also analyze infill wall effect in large span building (like Flat or PT Slab).

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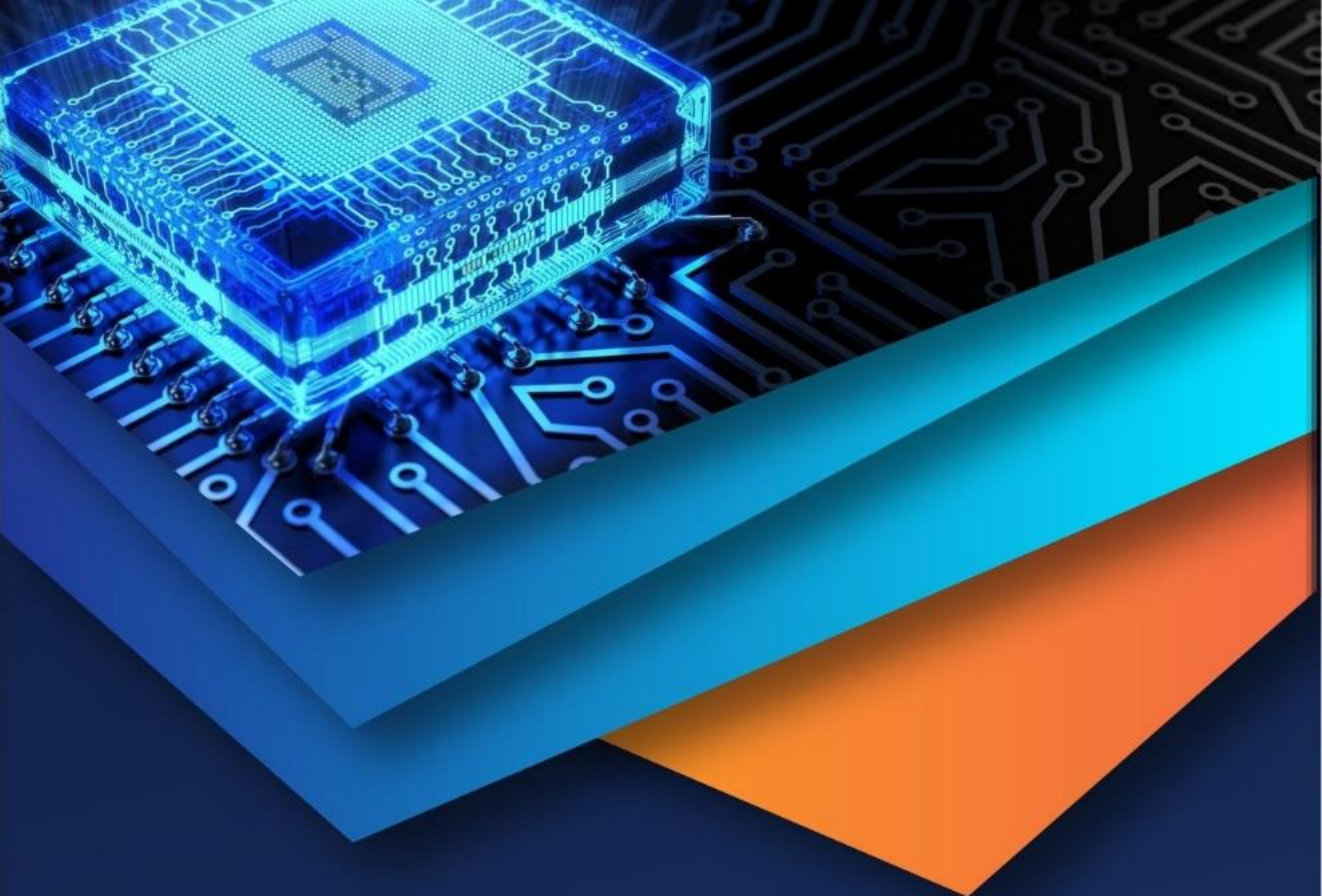

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