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Seismic Performances of Multistorey Residential Building with and without RCC Shear Wall Structure with ACC Block

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Abstract— *This study investigates the dynamic characteristics, seismic response, structural stability of a building structure under seismic load case in zone V and also the study of shear wall. We are going to understand little bit about ACC BLOCK and why giving the More importance to acc block instead of bricks .Most of the building structure are constructed in zone IV and zone V so these types constructed building structure easily damage by earthquake so we have to perform dynamic analysis for safety and stability of structures .The Aim of this study is to compare the results of dynamic analysis of building with shear wall and without using the shear wall .we are going to create a model in ETABS software with (G+5) story building and foundation to ground floor height is 1 m, ground floor to first floor height is 3.75 m and 1st to terrace story height is 3.3m,above terrace is different-different height and we are taking reinforced cement concrete sheal wall with thickness of 230mm and in the length of 1.5m and placing different -different location. In the dynamic analysis we are going to use the response spectrum analysis method in the software of ETABS ultimate 21.1.0 .and we apply the Indian standard code of earthquake IS 1893:2016*

Keywords— ***Reinforced concrete shear walls, earthquake, response spectrum analysis, IS 1893:2016, ACC block***

I. INTRODUCTION

In India, there are so many states are in the earthquake zone and earthquake is the sudden shaking of the Earth's crust, are a recurrent phenomenon in this diverse and dynamic subcontinent, As seismic events continue to influence.

the topography, society, and infrastructure of the nation, India's Bhuj is one of them state India have, which face the disaster by earthquake.

Natural disasters have the power to reshape landscapes, societies, and individual lives in a matter of moments.

Fig.1. Seismic Zone Map of India

The Bhuj earthquake of 2001 stands as a poignant reminder of the destructive force inherent in the Earth's tectonic dynamics. Striking the Kutch district of Gujarat, India, on

January 26, 2001, this seismic event left an indelible mark on the region, affecting not only the physical environment but also the lives, livelihoods of the communities it to

Fig.2. The Bhuj Earthquake Of 2001

The Bhuj earthquake, with a moment magnitude of 7.7, emanated from a fault near the village of Chobari in the Kutch district. Understanding the geological aspects, such as the converging tectonic plates and the specific fault lines involved, is imperative in comprehending the origins and propagation of this seismic catastrophe.

Impact on Human Life

The human toll of the Bhuj earthquake was staggering, with casualties ranging from 13,805 to 20,023 people. This loss of life highlights the vulnerability of populations in earthquake-prone regions and underscores the need for infrastructure damage

There are following term which can be affected by the earthquake are given below:

1. Economic Consequences
2. Infrastructure damage
3. Response and Relief Efforts
4. Social and Psychological Effects
5. Seismic Hazard Assessment

The Bhuj earthquake of 2001 serves as a paradigmatic case study of the far-reaching impacts of seismic events. From the geological origins to the social, economic, and psychological aftermath, a comprehensive examination of this disaster offers valuable insights for researchers, policymakers, and disaster management professionals. By learning from the past, we can strive to build more resilient communities that are better equipped to face the uncertainties of the future.

Shear Wall

A building structure carry a horizontal and vertical forces or load and we all know that shear wall resist lateral forces of building structure. As we all want that from our structure with the help of shear wall a building structure remains stable because shear wall transfer the lateral forces the ground foundations.

Fig.3. Construted Image of Shear Wall

The main work of shear wall in multistorey building:

1. Providing a Rigidity to the structure
2. Providing a stability which is more important
3. Providing a lateral strength
4. Providing a lateral stiffness

Placing of reinforced cement concrete shear wall:

Placing of shear wall is most important in multistorey building so shear wall placing in structure should symmetrical and we should provided shear wall in lift area is also important.

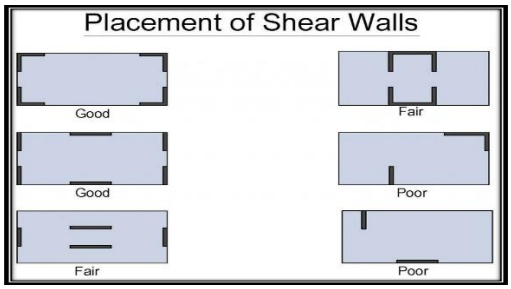

Fig.4. Placement Of Shear Wall

ACC Block

Autoclaved Aerated Concrete (AAC) block is a low-maintenance precast building material with excellent thermal insulation and durability. The heat-insulating properties of AAC blocks keep the building cooler and prevent outside heat from entering, resulting in significant savings on air conditioning costs. AAC blocks also guarantee savings in foundation.

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Fig.5. ACC Block

Types of ACC Block

1. Fire Resistant AAC Block
2. 200 Mm AAC Block
3. 100 mm AAC Block
4. Long-lasting AAC Block
5. Rectangular Fly Ash ACC Blocks

Advantages OF ACC Block

1. Easy & Faster Workability
2. Sustainable And Pocket-Friendly
3. Soundproof
4. Fire resistance

II. METHODOLOGY

Dynamic analysis by response spectrum method we are creating two model in which 1st is without shear wall building structure and 2nd is with shear wall building structure.

Response Spectrum Analysis (RSA) is a powerful tool in earthquake engineering for assessing the dynamic response of structures subjected to seismic ground motion. It involves the application of a response spectrum, which is a graphical representation of a structure's response to a range of ground motion frequencies

In the realm of structural engineering, where the forces of nature can shape the destiny of built environments, the quest for understanding and predicting a structure's behavior under seismic forces has given rise to sophisticated analytical methods. Among these, Response Spectrum Analysis (RSA) stands out as a pivotal tool, providing engineers with a comprehensive means to evaluate and enhance the seismic resilience of structures. This essay delves into the intricacies of Response Spectrum Analysis, examining its principles, applications, and significance in the context of earthquake engineering body

Dimensions of Multistorey Building

We are going to create a structure in ETABS software which dimension is

Height of building- 26.75m

Length of building - 23m

Width of building- 42m

Table 1. Seismic Parameter

Name	Value
Seismic zone	V
Zone factor	0.36
Response reduction factor(R)	5
Soil type	Medium soil (II)
Importance factor(I)	1

Table 2. Live Load: Is 875 Part 2

LIVE LOAD			
Bedroom	2	KN/m2	875 part2
Toilet	2	KN/m2	875 part2
Kitchen	2	KN/m2	875 part2
Lobby	3	KN/m2	875 part2
Balcony	4	KN/m2	875 part2
Store room	3	KN/m2	875 part2
Drawing room	3	KN/m2	875 part2
Corridor	3	KN/m2	875 part2
Closet	2	KN/m2	875 part2
Utility	2	KN/m2	875 part2
Staircase	3	KN/m2	875 part2
Terrace	1.5	KN/m2	875 part2

Multistorey Building with Shear Wall

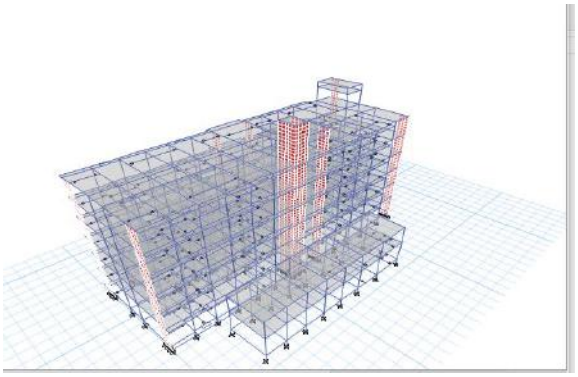

Fig.6. D View of Structure

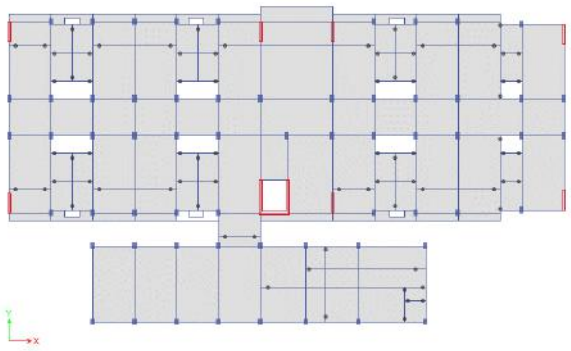

Fig.7. Plan View of Structure

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MULTISTOREY BUILDING WITHOUT SHEAR WALL

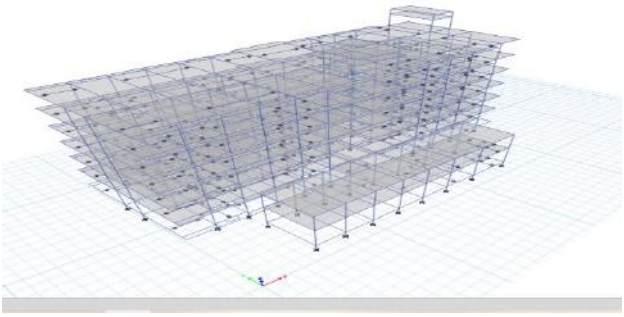

Fig.8. D View of Structure

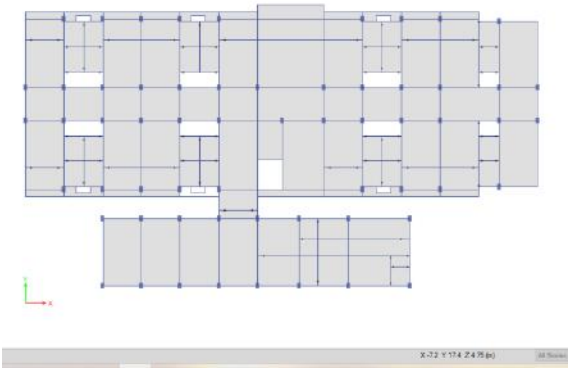

Fig.9. D View of Structure

III. RESEARCH OBJECTIVE

In seismic-prone regions like India, the structural integrity of buildings is paramount for ensuring the safety and resilience of communities. This research aims to conduct an in-depth investigation into the seismic performance of an five story reinforced concrete (RCC) residential building, utilizing Response Spectrum Analysis (RSA) as per the guidelines outlined in the code of Indian Standard IS 1893:2016 Criteria for Earthquake Resistant Design of Structures.

Evaluate Seismic Performance:

Assess the seismic performance of the five story RCC residential building under various ground motion scenarios using Response Spectrum Analysis.

1. Structure safety and stability
2. To evaluate multistorey building performance under seismic loading
3. To check the durability of structure
4. Compare the result of multistorey building with shear wall and without shear wall
5. To make economic structure
6. Constructability and ease of maintenance

IV. RESULTS

There are so many parameter which can be compared but we are going to compare the three parameter that is

1. Torsion/Time period
2. Max story drift
3. Max story displacement

MAXIMUM STORY DISPLACEMENT AND MAXIMUM STORY DRIFT OF WITHOUT SHEAR WALL MODEL

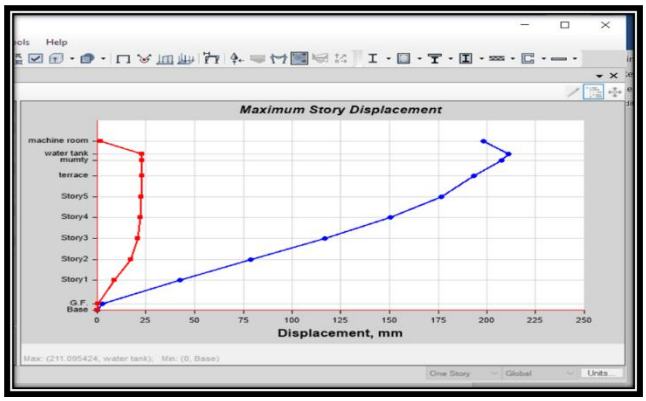

Fig.10. Max Storey Displacement for X Direction Without Shear Wall

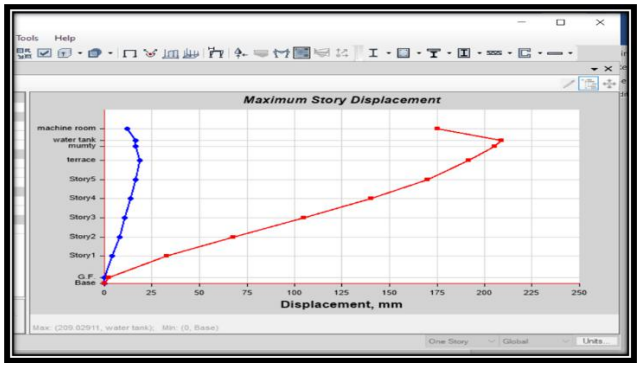

Fig.11. Max Storey Displacement for Y Direction Without Shear Wall

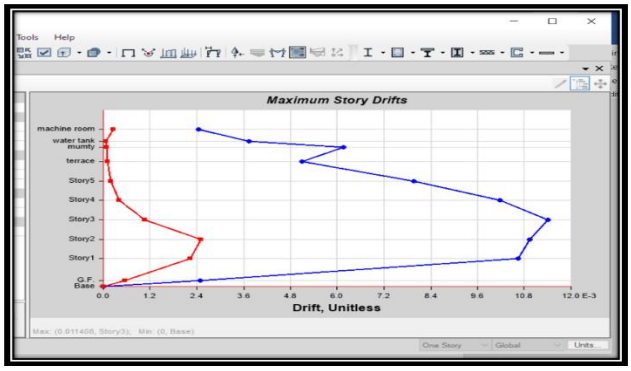

Fig.12. Max Storey Drift for X Direction Without Shear Wall

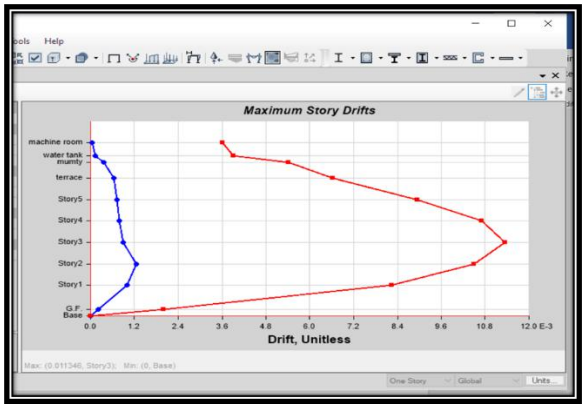

Fig.13. Max Storey Drift for Y Direction without Shear Wall

MAXIMUM STORY DISPLACEMENT AND MAXIMUM STORY DRIFT OF WITH SHEAR WALL MODEL

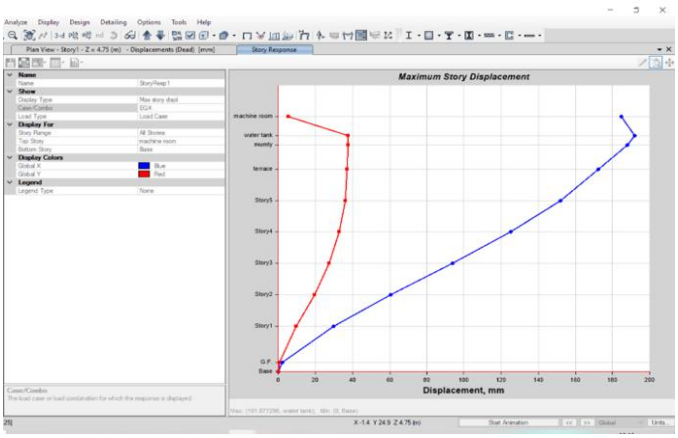

Fig.14. Max Storey Displacement for X Direction

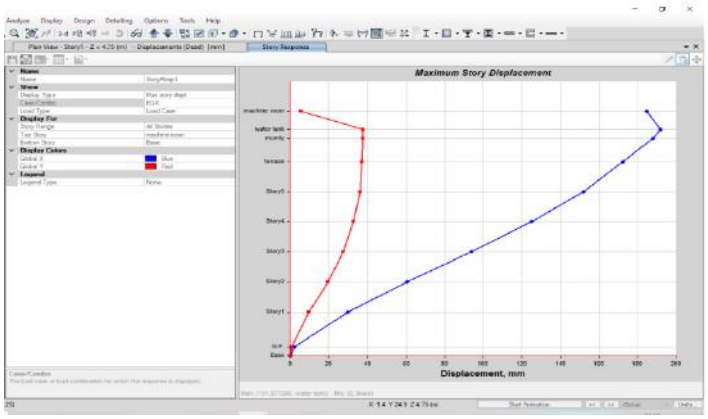

Fig.15. Max Storey Displacement for Y Direction

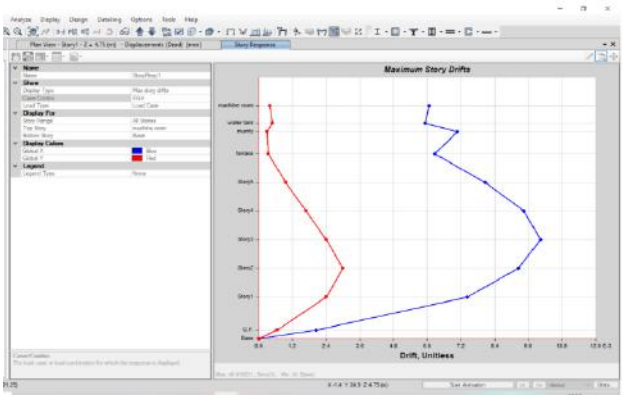

Fig.16. Max Storey Drift for X Direction

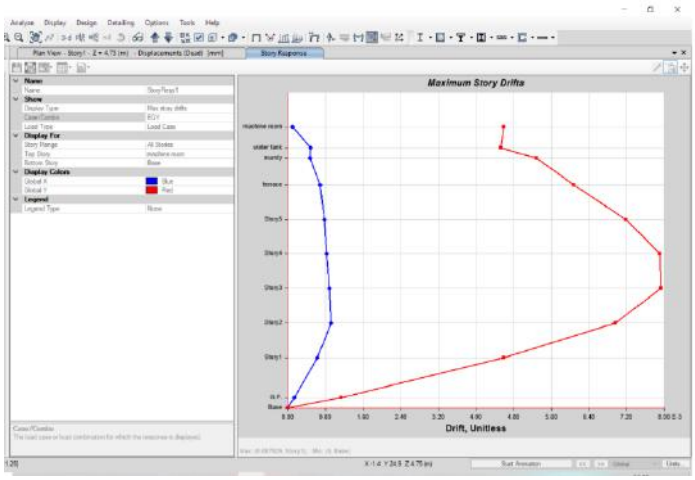

Fig.17. Max Storey Drift for Y Direction

CAMPARE THE TORTION /TIME PERIOD OF MULTISTOREY BUILDIN WITH SHEAR WALL AND WITHOUT SHEAR WALL

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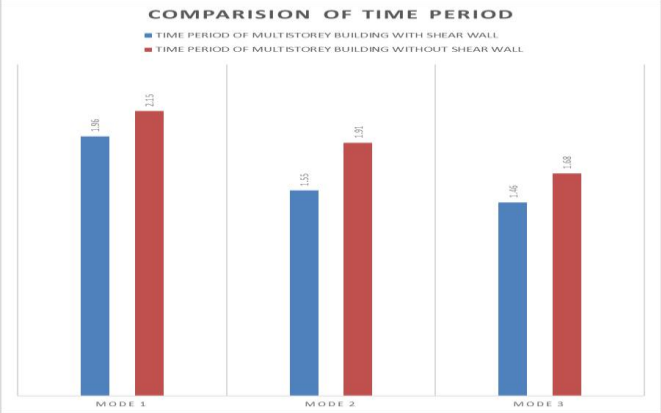

Fig.18. Comparison of Time Period

V. CONCLUSION

From this study we have so many conclusion which is following

1. The change in maximum story displacement in x direction is 25-50mm in compare of with shear wall or without shear wall.
2. The change in maximum story displacement in y direction is 50-60 mm in compare of with shear wall or without shear wall.
3. The change in maximum story drift in x direction is 0.01-0.013 in compare of with shear wall or without shear wall.
4. The change in maximum story drift in y direction is 0.008-0.0113 in compare of with shear wall or without shear wall.
5. The torsion is present in without shear wall model while torsion is not present in with shear wall model.

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