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Seismic Analysis ofMulti-storeys Building having Infill Wall, Shear Wall and Bracing.

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Abstract: *Multi-storeyed structures are gaining wide popularitynow days. Generally any structure which has height more than 35 metres is considered as a high rise structure. Due to the increasing need of the high rise structures in the urban areas, construction of many of high rise structures are in progress and hundreds of them will take place in future. But the most important aspect in this whole scenario is the safety and sustainability of these structures against natural disasters such as earthquake. The main objective of this project is to study different techniques for resisting lateral forces acting on structure. The methods studied and analysed are SHEAR WALLS and BRACING. The project also aims at finding the most suitable method along with design of a G+25 structureusing INFILL WALL, SHEAR WALL and BRACING. The analysis is carried out using analytical methods as well as ETABS software.*

1. Introduction

The high rise building is mostly considered as the one which requires mechanical transportation for use. High rise building is the one which has a height of 35 metres or more than that. As the height of buildingincreases,the loads coming on the building also increase, which may affect the stability of building. Thus addition of some extra structural elements is required for the safety from loads acting on the building.

Our project hence focuses on the use of these additional structural elements discussed in above paragraph in a G+20 floor building. The structural elements used are Shear Wall, Bracing. A comparative analysis of shear wall and bracing with respect to the stability of the structure has been carried out using software. Generally the loads coming on the most of the structures are dead load live load wind load, earthquake load.

2. Problem Statement

The main reason for the structural damages is the lateral or horizontal forces due to release of earthquake energy. These lateral forces are also induced due to high wind load. The structures with rigid base or we can say ordinary structures are most unsafe during earthquakes as they are subjected to inertia forces during earthquake, these inertia forces cause collapse of structure, damages to the structures. Due to the inertia forces, there is sudden failure of structure, which gives very less time for users to escape out of structure. This results in increased loss of human lives.

3. Objectives

The study has following objects:

1. The main objective is to increase the resistance of structure against lateral forces/ground motion which is produced by earthquake.

2. To prevent the additional cost and operation of retrofitting of structure in future.

3. To increase the accessibility time for users to escape out from structure during earthquake.

4. Scope of Project

The original scope of this project is to improve the safety of the high rise structure by provision of structural elements viz. Shear wall, Bracing. Three buildings of respectively 15, 20 and 25 floors have been designed with Infill wall (normal brick wall), Shear wall and Bracing. Out of the three methods used the most suitable structural element is found out by the analysis of the results obtained.

5. Literature review

1. Criteria for far earthquake resistant design of structures (IS 1893- Part 1: 2002)

This IS Code was adopted by the Bureau of Indian Standards, after this draft was finalised by the Earthquake Engineering Sectional Committee and has been approved by Civil Engineering Division Council. It deals with the assessment of seismic loads on various structures and earthquake resistant design of buildings.

2. Full scale implementation of active structural control

By T.T. Soong, A.M. Reinhorn, R.C. Lin (State University of New York, U.S.A)

An active bracing system has been designed and its response is tested against seismic loads. In this paper the topics addressed are design, fabrication and performance issues related to the development of bracing system. The performance of system and lessons learned are discussed. These discussions provide a realistic analysis of the benefits of bracing systems, as well as capability and different requirements of the systems.

6. Theoretical investigation

A theoretical study has been done on

	G+25 INFILL	G+25 BRACING	G+25 SHEAR
G+25	33.35	29.1	7.3

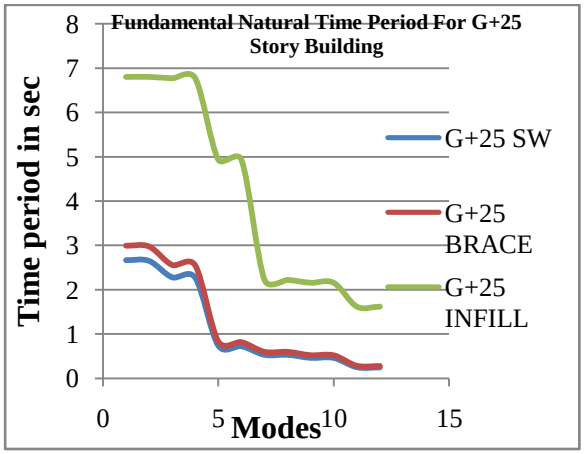
Shear wall and Bracing system. In this study the areas highlighted are basic concepts of the methods, forces resisted, importance and advantages of shear wall and bracing respectively, different types of Bracing along with their suitability. Also, the different methods of analysis of structures have been stated in brief.

7. Parametric study

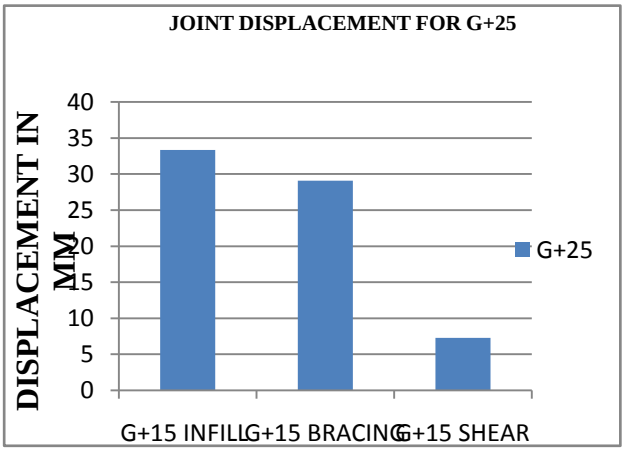
The analysis of the building can be done in different ways. So we have done the analysis manually for the infill wall and the building with shear wall and bracing has been done using ETAB'S software.Building of G+25 floorshas been used for analysis. The results of the analysis are obtained in the form of graphs. The parameters of the analysis are Time period, Base shear and Joint displacement.

1. Time Period

	G+25 SW	G+25 BRACE	G+25 INFILL
1	2.66555	2.995	6.806
2	2.64864	2.976	6.806
3	2.27929	2.561	6.775
4	2.2695	2.55	6.775
5	0.74137	0.833	4.934
6	0.7298	0.82	4.934
7	0.53489	0.601	2.22
8	0.53489	0.601	2.22
9	0.46725	0.525	2.155
10	0.46547	0.523	2.155
11	0.25543	0.287	1.617
12	0.25098	0.282	1.617

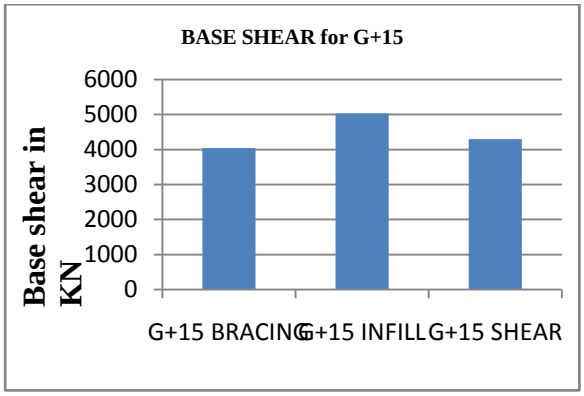


2. Joint Displacement



3.Base shear

	G+25 INFILL WALL	G+25 BRACING	G+25 SHEAR WALL
BASE SHEAR	5033.113	4038.413	4312.5



6. Conclusion

This paper focuses on improving the resistance and stability of high rise building against the different loads and forces (mainly seismic forces) it is subjected to during its life time.

The three most important factors responsible for the overall stability of any building are Time period, Base shear and Joint displacement. The results from analysis are summarised below.

1. Time period much less when shear wall is used.

2. Joint displacement is a minimum when shear wall is used.

3. Base shear is a minimum when bracing is used.

From the above graphical results it is evident that infill walls should be avoided in high rise buildings as the performance of these structures when subjected to different forces is not satisfactory. In case of base shear, the difference in the results of shear wall and bracing is not very high.

Thus, it can be concluded that 'SHEAR WALL' proves to be the best alternative for improving the sustainability, force resistance and uniformity of high rise buildings.

7. References

7.1 Research papers

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7.2 Software's

1. AutoCAD
2. ETAB's

7.3 IS Codes

IS 1893: 2002 (Part 1)