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Comparison of regular buildings with and without core wall

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ABSTRACT

*A detail study of structural behaviour of the regular buildings with and without core wall Is done under seismic load which is essential for appropriate design and their better performances. In the present study 4*3 bay, 5 storey medium rise structure with provision of lift core wall and each storey height 3m is considered. analysis done by using e tab software. The analysis are carried out under different soil condition i.e hard soil, medium and soft soil. Responses for storey drift and displacement is plotted for different soil conditions.*

Keywords : Base Shear, Core wall, E-Tabs, Infill loads, Joint displacement, Storey drift, Seismic Behaviour

I. INTRODUCTION

The rapid development of urban population and the pressure on limited space significantly influence the residential development of the city. The price of the land is increasing day by day, the desire to avoid uneven and uncontrolled developing of urban area and bear the needs of land for important agricultural production activity have all led to route residential building upwards. The local topographical restrictions in the urban area are the only cause for the construction of multi-storey buildings to full fill the residential needs.

A core wall is nothing but a shear wall provided in the centre of the building to give more resistance to the building. These are the reinforced concrete members provided to withstand lateral loads in the high rise building. Core walls will be provided throughout the height of the building. These are provided around the stair case or lift or around the both. Core wall will provide more strength and stiffness to the structure.

Core wall be designed according to the code provisions. Core wall in the building acts like cantilever beam started from the base. Core wall has shear force and bending moment because of its height. Around the core wall slabs are connected to it and on the other side connected to the columns and beams are connected in the same way. It has high moment of inertia; hence it can withstand more loads. Core walls built with impervious materials like steel, asphaltic concrete are provided as embankment of dam which prevents water leakage.

Increase in population particularly in metro cities, has resulted in demand for multi-storeyed buildings. As land available for construction is limited, this has forced the planners to resort to vertical growth of the buildings in form of multi-storeyed buildings. A building frame is subjected to both vertical as well as horizontal loads. The vertical load consists of the dead weight of the structural components such as beams, slabs, columns etc. and imposed load. The horizontal load consists of wind forces and earthquake forces. The ability of multi storied

building to resist wind and other lateral forces depends on the rigidity of connections between the beams and columns.

The main objective of this project is to compare the regular building with & without core wall under earth quake forces. Reinforced 5 storey's framed structure is considered in the study and these types of buildings are mostly observed in earth quake zone. Comparison to be done between regular buildings on the basis of joint displacement, storey drift, base shear. Mainly we consider hard, medium and soft soil condition and how the result of the structure varies.

II. MODELLING AND ANALYSIS

2.1. Introduction

ETABS- Extended Three Dimensional Analysis of Building Structures is developed specially as a computer program for building systems. ETABS is now being used as an integral part of structural engineers, as to create larger, more complex analytical models and to analyse using static and dynamic properties. This creating, modelling and analysing, designing is possible as the interface is integrated with Microsoft windows. The results are displayed graphically; also real time output of time-history displacements can be produced. ETABS provides the user to construct a model as that of a real building like the terms used in here are column, beam, brace, and wall, unlike that like nodes and finite elements. ETABS provides easy interface for using beams, columns, walls in steel or concrete. Seismic and wind loads are generated accordingly to the needs of code requirements which are made inbuilt in this computer program. The results can be got in ready format to make a document, making the work a time saving one.

The working in the software is very easy. Firstly establish grid lines, define material property, structural property, define loads and types of load combinations and assign the restraints and loads accordingly. Define the seismic and wind loads according to the code requirements and then analyse it for any errors and then run the model. The results will be got in the form of a tabular forms and also graphically which can be directly taken the printout of these results and filed in a document. Different building models are analysed in ETABS. The properties of building configurations are considered In present work are summarised below.

2.2. Models

Following are the different models which are consider in the analysis with plan irregularity under different soil condition**.**

2.2.1 Model 1: Regular Building Without Core Wall

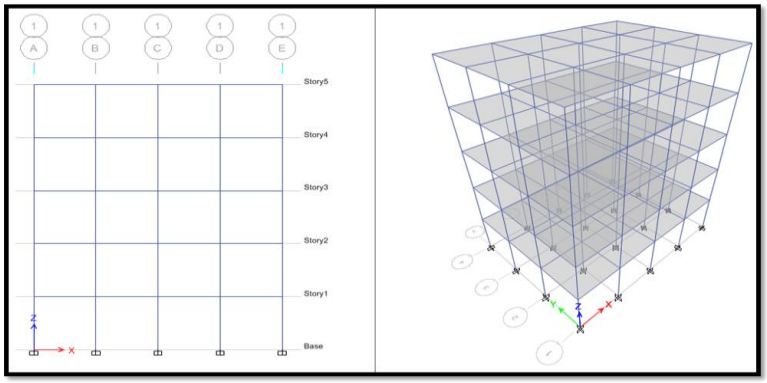

Fig 2.1: Elevation and 3D view of regular building without core wall

2.2.1 Model 2: Regular Building With Core Wall

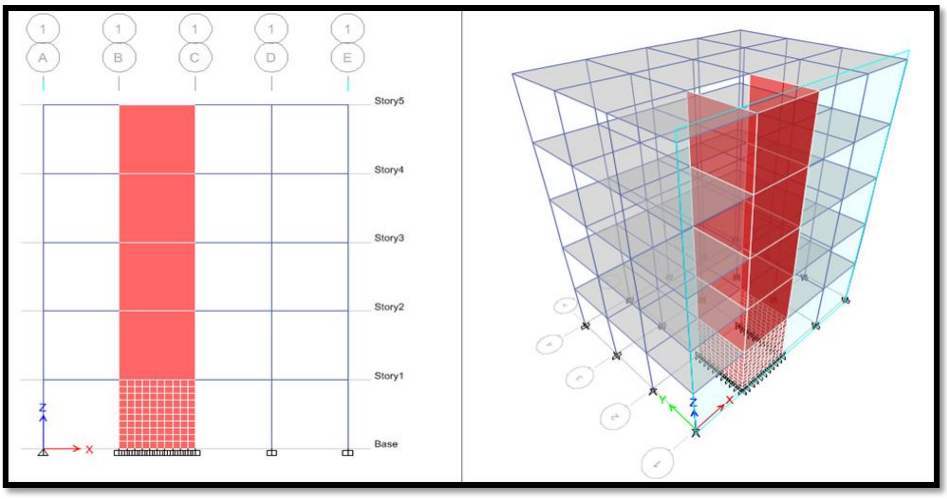

Fig 2.2: Elevation and 3D view of regular building with core wall

III. RESULTS AND DISCUSSION

3.1 Storey Drifts

Lateral deflections are caused when buildings are subjected to seismic loads. The storey drift in any storey due to least specified design lateral load, with partial load factor of 1.0 shall not exceed 0.004 times the storey height, as per clause 7.11.1 IS1893:2000

Table 3.1 Regular building without core wall

STOREY	HARD SOIL	MEDIUM SOIL	SOFT SOIL
1	0.001735	0.00198	0.00243
2	0.002119	0.002416	0.002967
3	0.002049	0.002327	0.002857
4	0.001701	0.0019	0.002333
5	0.00097	0.001016	0.001247

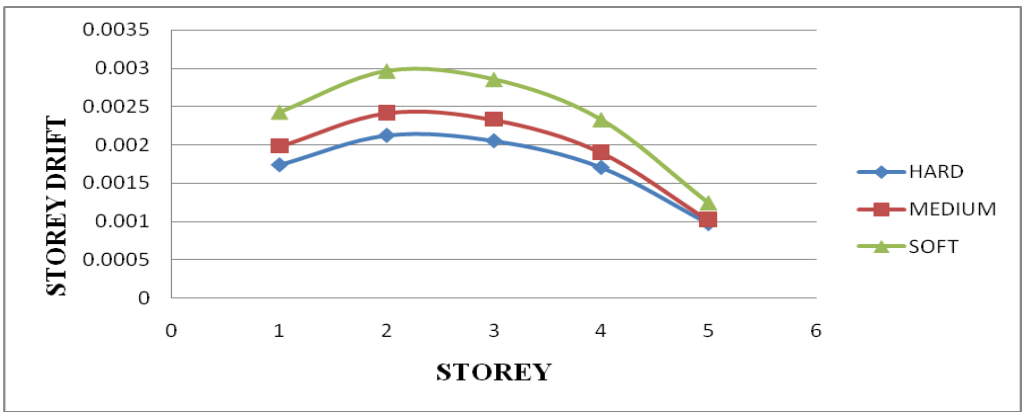

Fig 3.1: Regular building without core wall

3.1.1. Regular building with core wall

TABLE 3.2: Storey drift of regular building with core wall

STOREY	HARD SOIL	MEDIUM SOIL	SOFT SOIL
1	0.00067	0.001096	0.001328
2	0.001216	0.001648	0.001996
3	0.00148	0.001729	0.002094
4	0.001518	0.001456	0.001761
5	0.001392	0.000967	0.001167

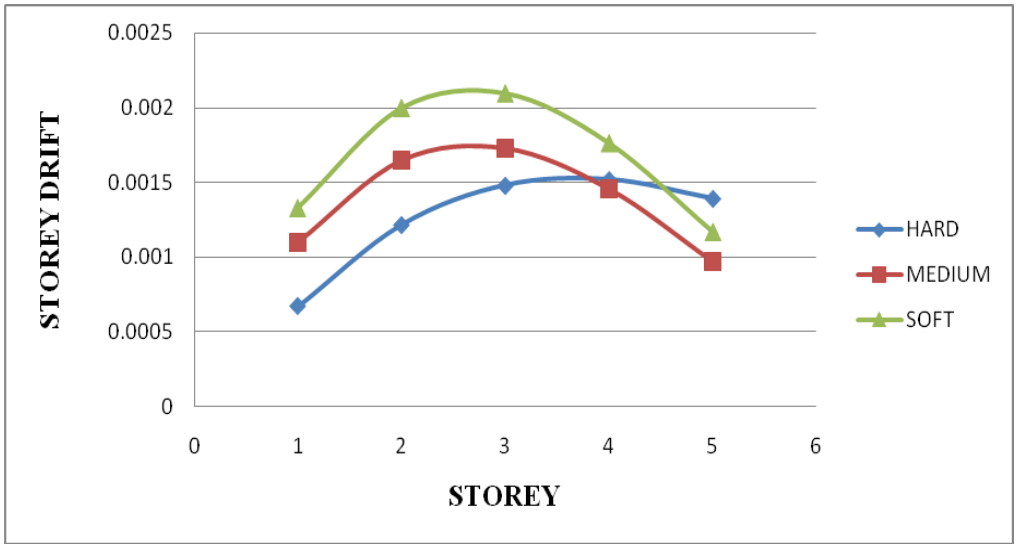

Fig 3.2: Storey drift of regular building with core wall

3.2.Displacement

The maximum displacement is consider along ‘x’ axis and ‘y’ axis.

3.2.1. Displacement of regular building without core wall

TABLE 3.3: Displacement of regular building without core wall

SOIL TYPE	HARD		MEDIUM		SOFT	
STOREY	H Ux	H Uy	M Ux	M Uy	S Ux	S Uy
1	3.2	5.2	3.7	5.9	4.5	7.3
2	7.8	11.6	8.9	13.2	10.9	16.2
3	12.3	17.7	14	20.2	17.2	24.8
4	16.1	22.8	18.2	25.9	22.4	31.8
5	18.3	25.7	20.6	28.9	25.3	35.5

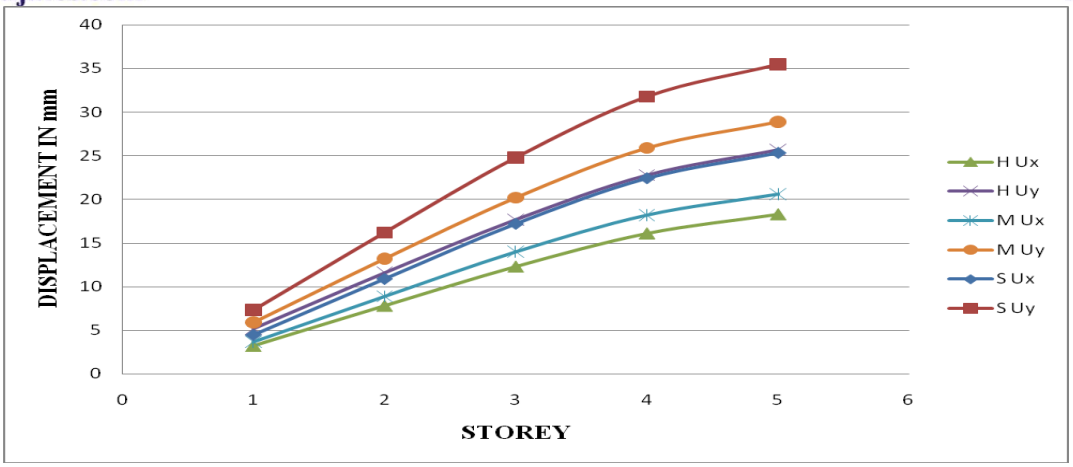

Fig 3.3: Displacement of regular building without core wall

3.2.2. Displacement of regular building with core wall

TABLE 3.4: Displacement of regular building with core wall

SOIL TYPE	HARD		MEDIUM		SOFT	
STOREY	H Ux	H Uy	M Ux	M Uy	S Ux	S Uy
1	2.5	2	3.3	2.8	4	3.5
2	6.2	5.7	8.2	9.8	10	10.2
3	10.1	10.1	13.4	14.2	16.2	15.8
4	13.5	14.6	17.8	18.9	21.5	22.5
5	15.8	18.8	20.7	22.8	25	28.8

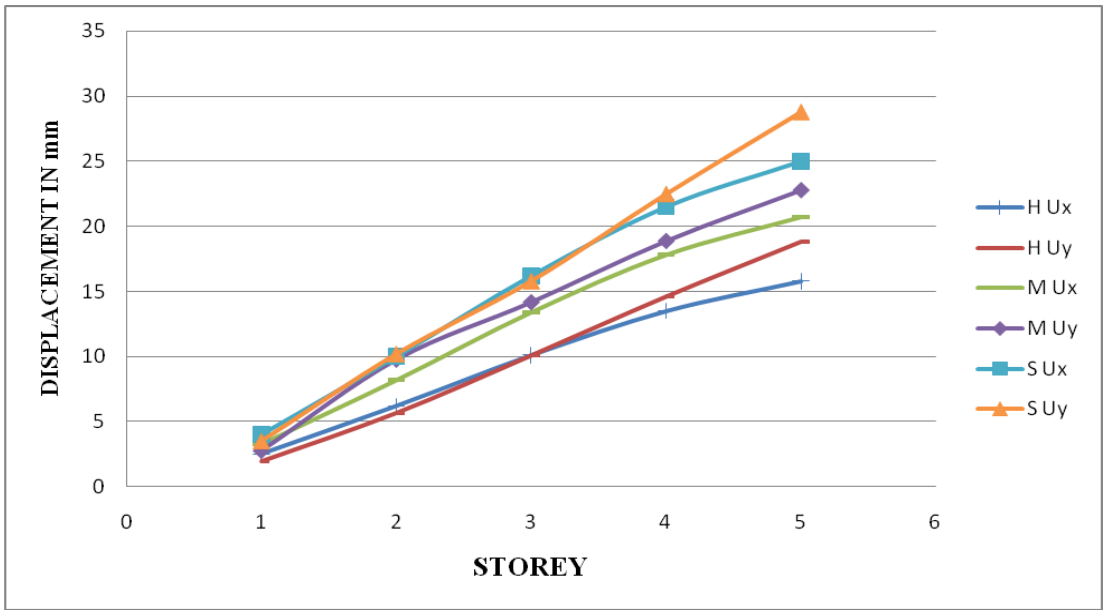

Fig 3.4: Displacement of regular building with core wall

IV. CONCLUSION

- Maximum story drift found at middle stories of the structure for all the models.
- Drift value of the building on soft soil building increased by 20% than medium soil building and medium soil buildings increased by 10% than hard soil buildings.
- Story drift of the building located on hard soil is less compared to the building located on medium and soft soil.
- As the drift value is less on hard soil, it is more suitable for the construction of buildings.
- Displacement of the structure decreases if the core wall is added to the structure and it will decrease more if the infill loads are added along with the core wall.
- Story displacement increased as the soil condition varies from hard to medium to soft soil.
- Maximum value of displacement is found in soft soil.

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BIOGRAPHAICAL DATA

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	**Prof. Manjunath S,** working as an Assistant Professor in the Department of Civil Engineering in SPCE from past two years. I have a total of 9 years of teaching experience. I have done my **B.E in Civil Engineering and M.Tech in Structural Engineering** from VTU. I am a research scholar, pursuing my **P.hd** in VTU and my area of research is water Resources, GIS and its applications.
	**Prof. Shirisha Y C,** working as an Assistant Professor in the Department of Construction Technology and Management in Acharya Institute of Technology from past three years. I have done my **B.E in Civil Engineering and M.Tech in Construction Technology** from VTU. I had qualified GATE in 2011. My research area of interest is Stabilised mud Blocks.