

COMPARISON OF CONVENTIONAL AND FLAT SLABS USING RESPONSE SPECTRUM METHOD FOR SYMMETRIC AND ASYMMETRIC COMMERCIAL BUILDING USING E TABS

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ABSTRACT: “Flat Slab” is better understood as the slab without beams resting directly on supports (like columns & or walls). By virtue of that large Bending Moment & Shear Forces are developed close to the columns. Flat slabs system of construction is one in which the beams used in the conventional methods of constructions are done away with. The slab directly rests on the column and load from the slab is directly transferred to the columns and then to the foundation. To support heavy loads the thickness of slab near the support with the column is increased and these are called drops, or columns are generally provided with enlarged heads called column heads or capitals. The provision requires structural engineer to perform linear static analysis for the design of a structure. Displacements, base shear, storey shears and overturning moments are the major factors that cause severe building damages due to earthquake. In the present work RCC flat slab structure and conventional slab structures are considered for comparative study of G+8 storey building which is situated in earthquake zone-v and for earthquake loading, the provisions of IS: 1893 (Part1)-2 2 is considered. A three dimensional modeling and analysis of the structure are carried out with the help of E-tabs 2 16 software. Linear Static Method of Analysis and Response spectrum analysis method are used for the analysis of both Flat slab structure and Conventional slab structure. The forces and all the relative displacements, storey shears and overturning moments that are developed in each of the structure are analyzed. The results that are obtained from the analysis are discussed. Further these results have been used for understanding the performance of flat slab structure and conventional slab structure under the effects of lateral loads and earthquake. The results are compared and found that flat slab structure perform well in earthquake condition than the conventional slab structure.

KEYWORDS: Displacements, Storey Shears, Base shear, Overturning Moments, Linear Static Analysis and Lateral Loads.

1. INTRODUCTION

The fast-growing countries are there in the world, in the context of developing country in the world India is one of those country at present is expeditiously growing in economic and nation developments infrastructure as population is increased day by day. Urbanization taking very fast developing and rate of urbanization rate is more, by keeping this context we are aiming to counteract those requirements to from or build the structures in the urban area. When the area comes under the earthquake zone or the high intensity of the wind and external load this are all factor affects the improvements the infrastructure

Normal routine in the design field as well as constructions in such manner that concrete slabs loads bear the concrete beams load coming from slab and beam is supported by the concrete column. These sequences of connection are well known as slab beam or beam slab construction. The disadvantages of these connections are these types of construction are by providing the beam we observe that floor to floor height is reduced, this type of construction and designs are avoided in such places in auditoriums, theatres, large public health care centres and function hall to improve the appearance of the interior where as the concrete slab connected straightforwardly carry to the column and bear the slab load this type of constructions suites for those above said buildings. Concrete flat slab may also know as beam less slab. The panel of the flat slab is known as the one part of the flat slab connected by the column that is centre of the column, and this panel divided by the two parts that is column strip or end strip or middle strip. The flat slab is strengthened by the increasing the thinness of the slab to avoid the (-ve) reinforcements and strengthen against shear.

The investigation of the flat slab was discovered and defined is Turner and eddy founded in 1914, they define the flat slab the slab which straightforwardly rest on the columns supported on the four side which means no beam element and also

supported by the walls on four side which may differs the in the construction. The advantages of the flat slab are minimum maintenance cost reducing the cost of construction gives better appearance and easy to construction.

The experiments on the flat slab are done to understand the performance of the joints that is column to slab and types of failures due to external heavy loading. And they also done experiments on flat slab to examine the punching shear strength at the column and slab joints of is depends on the ratio of the gravity and shear. The load transfer or moment transfer slab to column is very complex when the structure subjected to lateral loads and unbalanced moments of the flat slab. These complex moment are created in the flat slab is due to the torsion and shear generated in the column and slab joint this actions leads to carking of the flat slab and also reducing the rate of the stiffness in the flat slab.

1.1 FLAT SLAB

Usually RC flat slab is rest directly on beam and beam is rest on the columns this construction is so called as Beam-slab construction reduces available net clear floor height, hence in commercial structures like office, warehouse and public hall sometimes due to aesthetic appearance beam are not provided thus slabs are directly placed on columns. So these method of construction of slabs are directly supported on columns are known as Flat slab as shown in figure below.

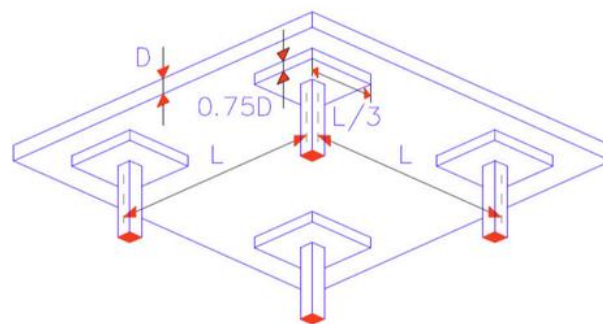


Fig.1. Types of Flat Slab

1.2 Types of Flat Slab Construction

1. Simple flat slab.
2. Flat slab with drop panels.
3. Flat slab with column heads.
4. Flat slab with both drop panels and column heads

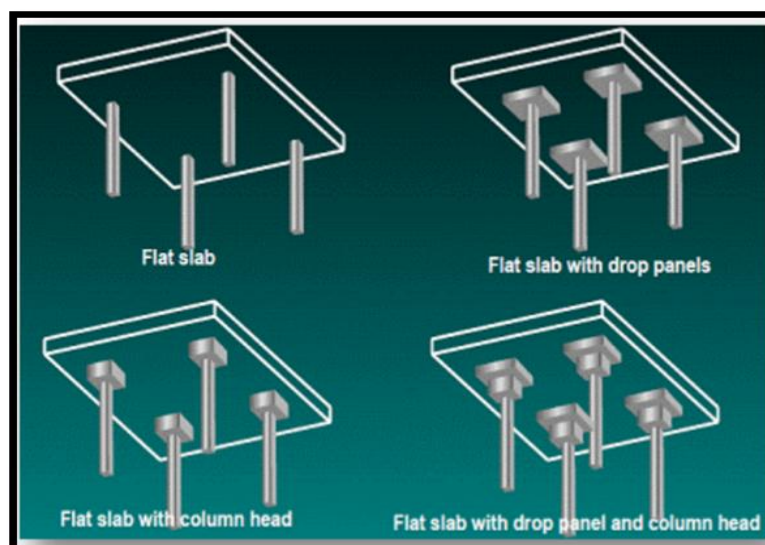


Fig.2. Types of Flat Slab

2. OBJECTIVES OF PRESENT STUDY

1. To perform Dynamic linear analysis (Response spectrum analysis), and on G+8 story RC frame building with Flat slab and conventional slab.
2. To perform Dynamic linear analysis (response spectrum analysis) on G+8 story RC frame building with symmetric and asymmetric building.
3. To get dynamic qualities like story shear, story drifts and story displacement of RC building by analysing by the response spectrum analysis.
4. To compare the results of story drift and story displacement of static linear and response spectrum analysis.
5. To compare the results of story drift and story displacement of all load combinations specified in IS 1893 2002
6. To compare the results of story drift and story displacement flat slab and conventional slab.
7. To compare the results of base shear of static linear and response spectrum analysis.
8. To compare the results of base shear of all load combinations specified in IS 1893 2002.
9. To compare the results of base shear flat slab and conventional slab.

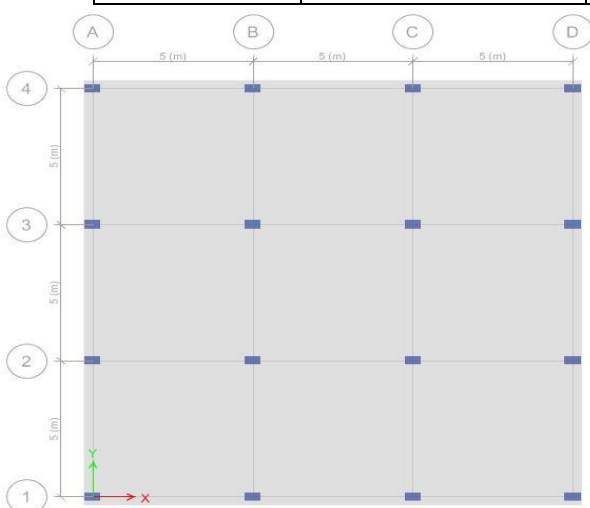
3. METHODOLOGY

The step by step procedure followed to achieve the above objectives is;

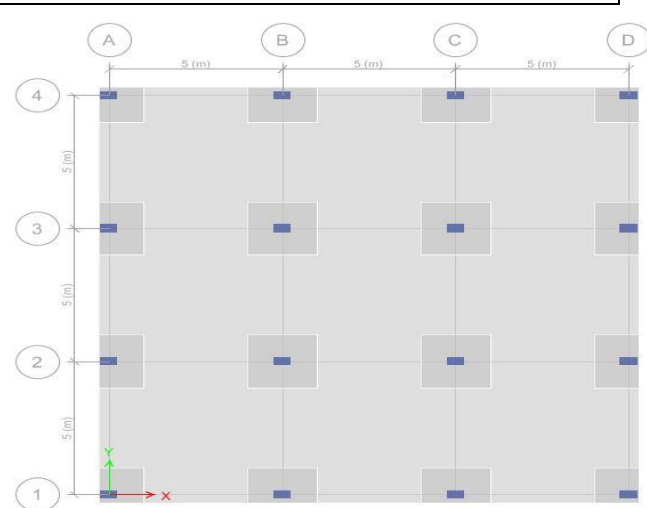
1. An extensive literature review is carried out, and identified the problem of work which parameter to consider to analysis.
2. To establish the above objectives for the project work.
3. G+8 storey structure is chosen for the present investigation.
4. ETABS software is chosen for modeling and analysis of the selected structure.
5. In the modeling flat slab and conventional slab in the symmetric and asymmetric building.
6. To understand the behavior of structure, total four models are considered with symmetric asymmetric plan configuration.
7. Dynamic linear analysis (Response spectrum analysis) is carried out by considering symmetric and asymmetric building.
8. The results are obtained from the models are checked and tabulated and represented in graphical form.

Table 1: Abbreviation of Models

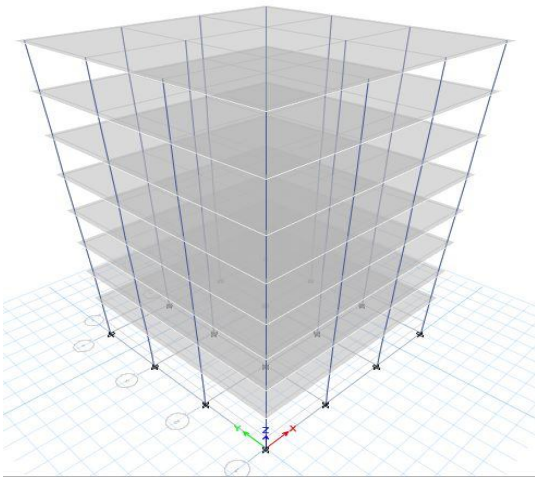
Sl No.	Model No.	Description
1	M-SC	symmetric plan configuration with conventional slab
2	M-SF	symmetric plan configuration with Flat slab
3	M-ASC	Asymmetric plan configuration with conventional slab
4	M-ASF	Asymmetric plan configuration with flat slab



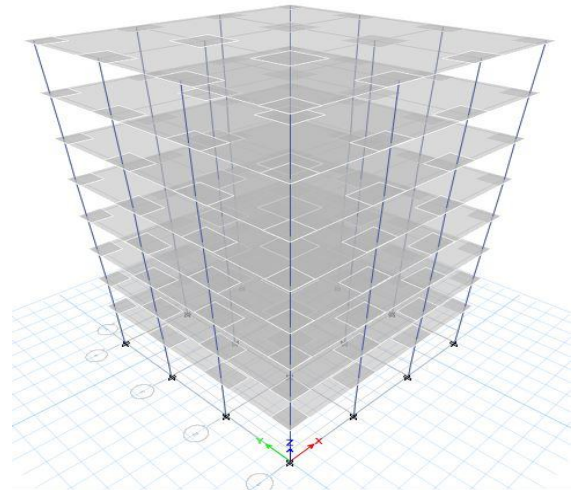
2(a)



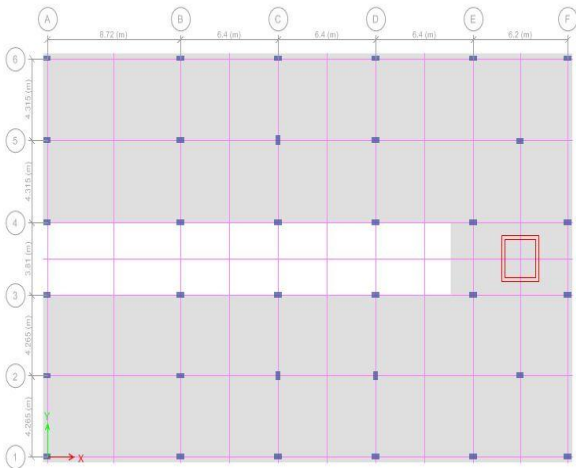
3(a)



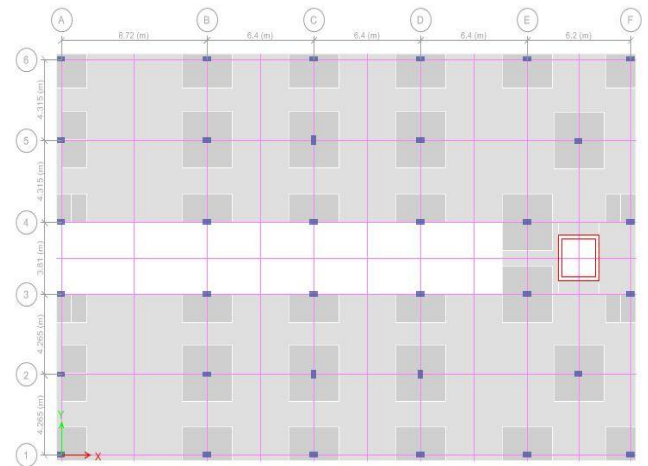
2(b)



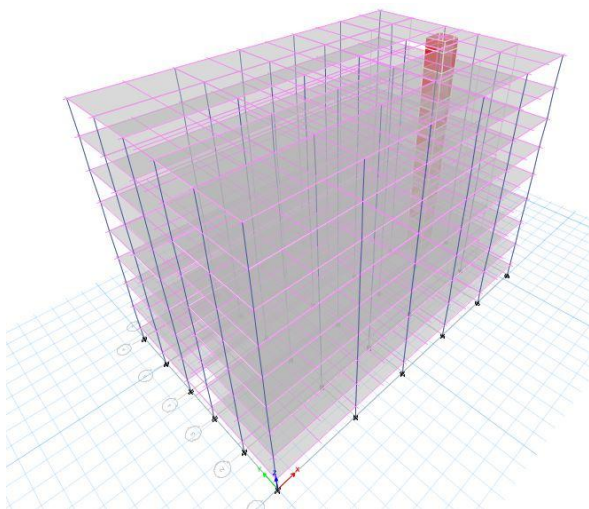
3(b)



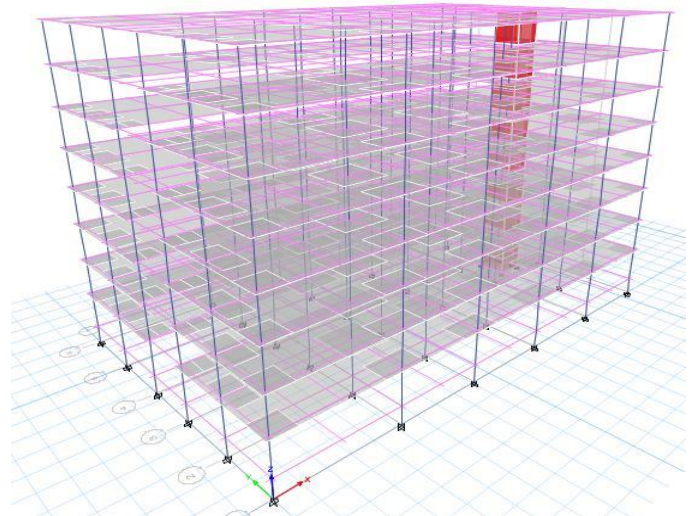
4(a)



5(a)



4(b)



5(b)

- Fig.2. Symmetric plan configuration with conventional slab, (a) Floor plan, (b)3d view.
- Fig.3. Symmetric plan configuration with Flat slab, (a) Floor plan, (b)3d view.
- Fig.4. Asymmetric plan configuration with conventional slab, (a) Floor plan, (b)3d view.
- Fig.5. Asymmetric plan configuration with Flat slab, (a) Floor plan, (b)3d view.

4. EXPERIMENTAL RESULTS

Storey displacement



Fig.6. Graph of storey displacement of M-SC M-SF M-ASC M-ASF.

Storey drift

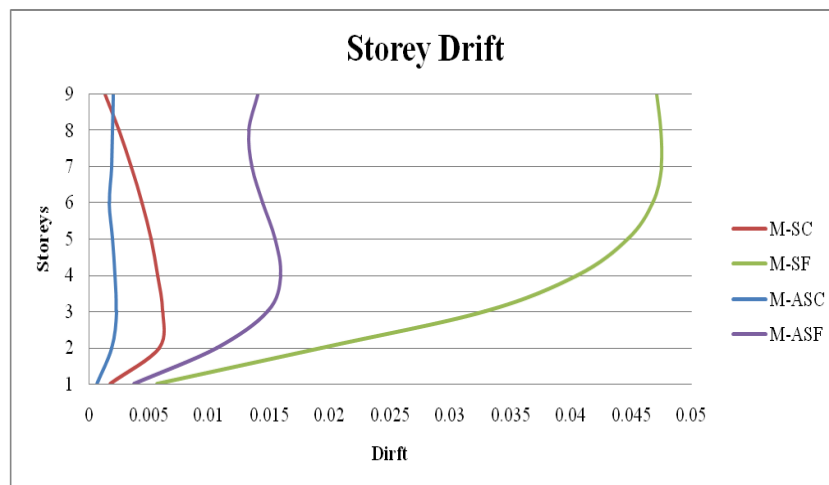


Fig.7. Graph of storey drift of M-SC M-SF M-ASC M-ASF.

Storey acceleration

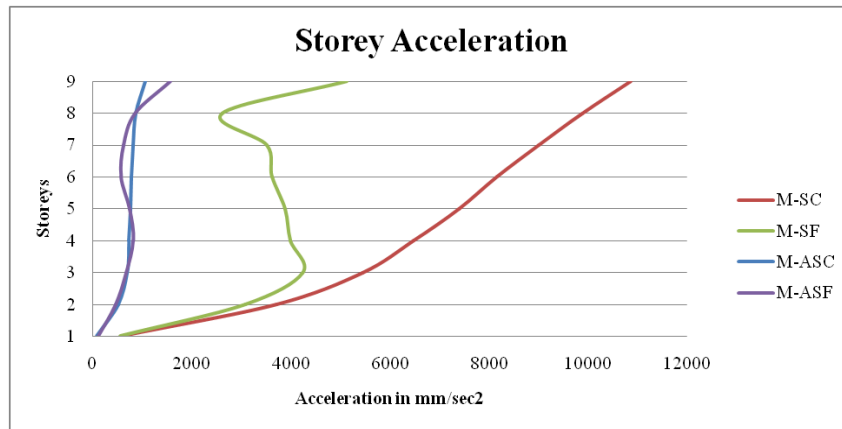


Fig.8. Graph of storey acceleration of M-SC M-SF M-ASC M-ASF.

Storey stiffness

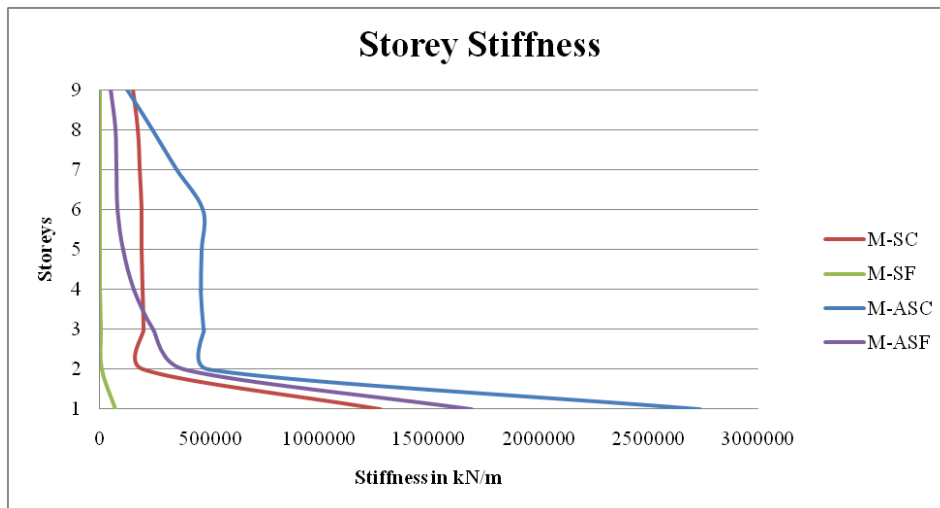


Fig.9. Graph of storey stiffness of M-SC M-SF M-ASC M-ASF.

Storey forces

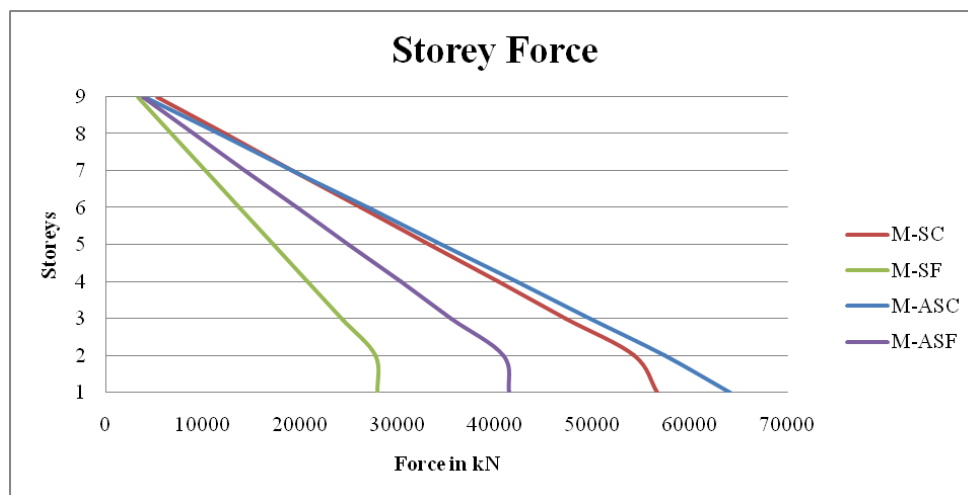


Fig.10. Graph of storey Force of M-SC M-SF M-ASC M-ASF.

5. CONCLUSIONS

In the above thesis four models are considered, two are high raised symmetric building with conventional slab and flat slab, and another two are high raised asymmetric building with conventional slab and flat slab. These models are analyzed by adopting the response spectrum method. The effects on models have been shown in the form of table and graphs in successive part of results and discussions, by comparing various parameters such as displacements, storey drifts, storey acceleration, storey force, storey Stiffness, and base shear. Hence from the obtained results the following conclusions are made,

- 1) Considering the effect of lateral displacement on structure. It has been observed that, building with flat slab displaced more in comparison to conventional slab in both symmetric and asymmetric building.
- 2) The lateral displacement is compared with symmetric conventional slab building to the building with flat slab has decreased rate of displacement observed about 2.76%, symmetric conventional slab building to the building with flat slab has decreased rate of displacement observed about 34.3%
- 3) The storey drift is compared with symmetric conventional slab building to the building with flat slab has decreased rate of drift observed about 29.2%, symmetric conventional slab building to the building with flat slab has decreased rate of displacement observed about 14%.
- 4) The storey force in the different slab type i.e., for conventional showed that both symmetric and asymmetric building model has a lower force than that for the symmetric and asymmetric building with flat slab has the reduction forces are about 45% and 55% respectively.
- 5) The storey stiffness is about 8% more in the symmetric building with flat slab then the conventional slab. The storey stiffness is about 61% more in the symmetric building with flat slab then the conventional slab.
- 6) The acceleration of the asymmetric building with flat slab have higher values is about 59.2% and acceleration of the symmetric building with flat slab have higher values is about 26.26%.
- 7) The base shear of the symmetric high raised building with flat slab has lesser base shear that is 18% in the symmetrical structure and 16% in the asymmetric this due to the load resistance in flat slab is more than the normal framed structure
- 8) In asymmetric building with flat slab have more additional structural members are required for the more strength to structure if is provided by the shear wall then it's better than the conventional slab.

From the above results so obtained from all the graphs is clear that building with conventional slab and flat slab has equal advantage and disadvantage as we additional structural members are provide then building with flat slab is most economical and effective to the earthquake activates in the earth quake prone area, shear wall give a better resistance against earthquake forces and offer a stable structure

6. SCOPE FOR FUTURE STUDY

Within the limited scope of the present work, the broad conclusions drawn from this work have been reported. However, further study can be undertaken in the following areas:

- 1) The present study includes symmetric and asymmetric plan buildings are considered for analysis that can be further extended to vertical irregular plan of buildings.
- 2) In the present study, Flat slab with periphery beams is considered for structure, further study may also be undertaken by Flat slab without periphery beam structure.
- 3) In the present study, fixed base is considered for the structure, further study may also be undertaken by considering of soil structure interaction.
- 4) In the present study liner static, linear dynamic and Non-linear static Pushover methods were used for analysis further study can be considered non-linear dynamic Time History method to analyse the building.

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