COMPARITIVE SEISMIC BEHAVIOUR ANALYSIS OF STRUCTURE WITH SHEAR WALL AT DIFFERENT LOCATIONS

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Abstract - *Due to the lack of space it becomes necessary to construct high raised buildings so as to cater and fulfill the needs of the people as per living standards. As such, it should be analyzed properly and then designed such a way that the structure should be safe and stable. Multi-storied buildings are generally preferred because it saves the cost of land in the restricted places and where the place is limited. . Shear walls are vertical elements of the horizontal force resisting system. Shear walls are constructed to counter the effects of lateral load acting on a structure. In residential construction, Shear walls are straight external walls that typically form a box which provides all of the lateral support for the building. When shear walls are designed and constructed properly, and they will have the strength and stiffness to resist the horizontal forces. In building construction, a rigid vertical diaphragm capable of transferring lateral forces from exterior walls, floors, and roofs to the ground foundation in a direction parallel to their planes. This study aims at comparing various parameters such as storey drift, storey shear, and displacement of a building under lateral loads based on strategic positioning of shear walls. The effect of shear wall location on various parameters is to be compared. The static and response spectrum method is used to obtain the overall performance level of a structure. The software used is ETABS 9.7.4 version.*

Key Words: Shear wall, equivalent static analysis, response spectrum analysis, displacement, storey drift, base shear and time period.

1. INTRODUCTION

Earthquake is one of the most dangerous natural hazard compare to all the natural hazards, it causing major damage to structures. When the structures are constructed very tall at the same time maintain the stiffness is also important. Tall structures are constructed very high they facing huge loading effects due to dominating lateral forces. The main lateral forces are earthquake forces, wind loads. Strength, serviceability, stability and human comfort is main design criteria for tall buildings.

Quake forces are unpredictable and random in nature, due to this the structures must design to resist those forces. The designing of structure is in the form they are better performing during different loading conditions. The main aim of the most codes is to give life safety execution among wide range and irregular earthquakes. The important consideration of execution based pattern is the structures that perform well in different loading conditions. Quake loads are to be thoroughly displayed in order to get to the authentic behaviour of structure with a reasonable understanding that damage is normal yet it ought to be directed.

Quake forces are most dangerous hazards it leads to both monetary and life losses. Huge losses are occur mainly due to building destroys or damage. Damages or losses are not only for virtue of vibration, it also due to landslides, floods, tsunami, fire etc occur at the time of earthquake. Subsequently, it is very basic need to design the structure to resist moderate to very high earthquake ground motions depending on the site area and type of the structure. If already constructed building is not designed for quake resisting then retrofitting is very difficult. Engineers are used equivalent static analysis and dynamic analysis for design the structures. Equivalent static method is adopted to design the structure up to 90m high, dynamic analysis method is used to design more than 90m tallness. Dynamic analysis will take the sort of a straight response spectrum analysis. In this study multi storey structure is analyzed and programmed by using ETABS. This study highlights the diverse sorts of the building tallness and the key reaction of the shear walls of the building. Walls are constructed vertically continuous which may give good acoustic and fire controllers between the apartments. At the same time they are suitable for structural planning. These walls can often utilize for lateral force resistances. The main purposes of the shear walls are to give symmetry in stiffness, tensional stability and overturning capacity of the foundation. Dynamic reactions of building under bona fide quakes, the occasion and precision of examination with the most normally got, Response Spectrum examination is contrasted and Equivalent Static Analysis.

1.1 Location of the shear wall

Shear dividers must be provided in every level of the structure it also include web cover space to get a box like arrangement.

Compass shear dividers are constructed symmetrically on every one of the four outside edges of the building. Sometimes shear wall dividers are provided inside of the structure it is mainly due to less space for the adequate compass width degree for the floor or housetop diaphragm.

Shear dividers are most advantageous when they are constructed vertically and supported on foundation divider or footings this shows in the figure. When shear dividers don't change in position some particular members of the structure got extra strength. Consider a segment of inside divider in a subfloor greater than a slip space due to this very less adjustment required in a divider. For subfloors through standard inclining sheathing the compass width degree is 3:1

When shear dividers don't change, particular parts of the building will oblige extra fortifying. For this divider to be utilized as shear divider, the subfloor notwithstanding its affiliations must be fortified close to the divider.

•Model 1: Shear wall square shape model

•Model 2: Shear wall inclined shape model

• Model 3: Shear wall Z shape model

• Model 4: Shear wall L shape model

2. BUILDING MODELLING

For this study, a 21-story building with a 3.2-meters height for each story, regular in plan was modeled. These buildings were designed in compliance to the Indian Code of Practice for Seismic Resistant Design of Buildings .The buildings were assumed to be fixed at the base. The buildings were modeled using software ETABS. Models were studied in all four zones comparison of lateral displacement, storey drift, time period, base shear for all structural models under consideration.

3. BUILDING PARAMETERS

Grade of concrete M25, Grade of steel Fe500

Number of storey	G+20
Typical storey height	3.2m
column size	500mm X500mm
Beam size	300mm X 600mm
Slab thickness	150mm
Shear wall thickness	300mm

4. BUILDING PLANS

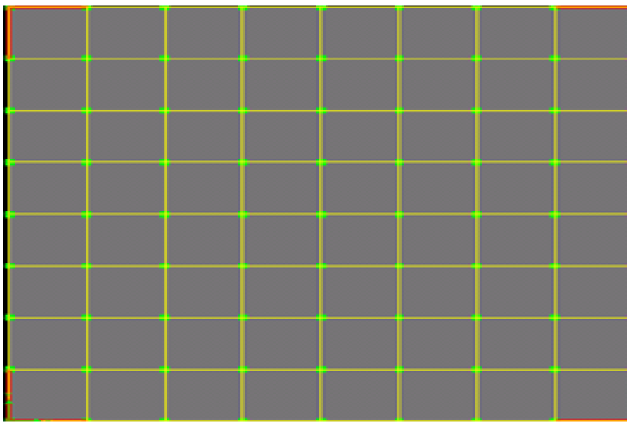

Fig.1 model 1

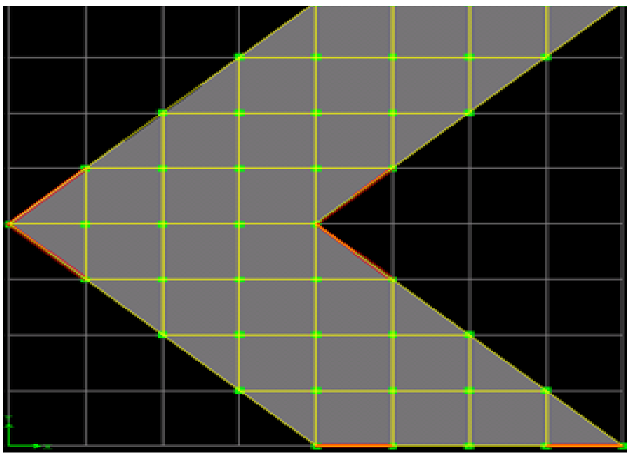

Fig.2 model 2

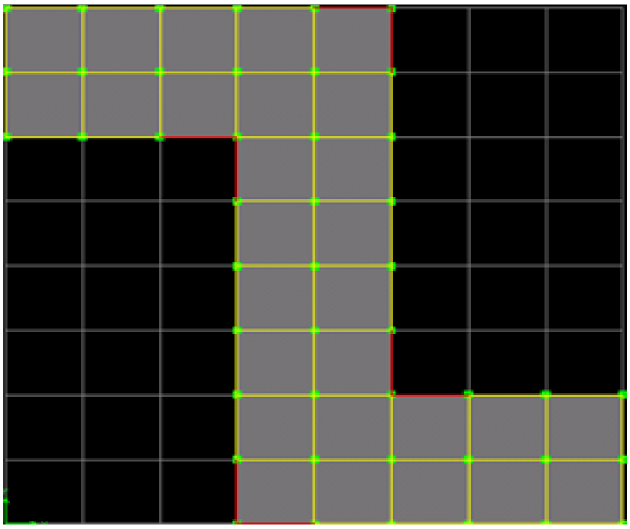

Fig.3 model 3

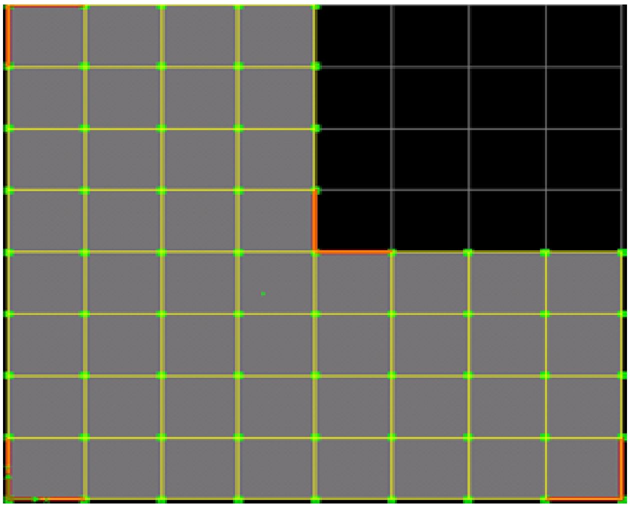

Fig.4 model 4

4.1 3-D Models of the Buildings

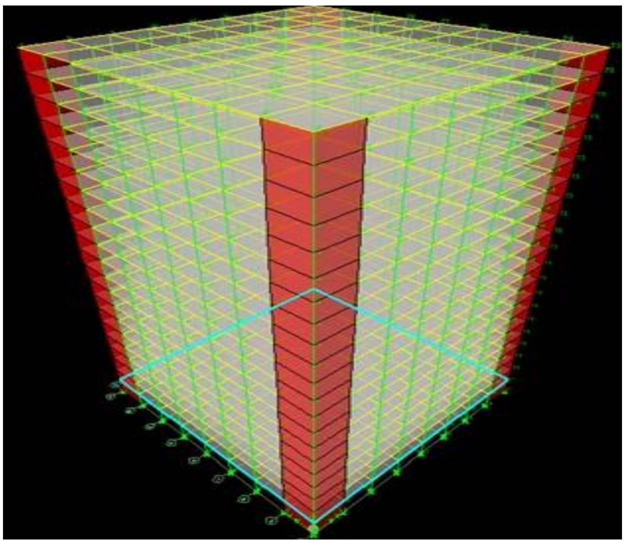

Fig.5 model 1

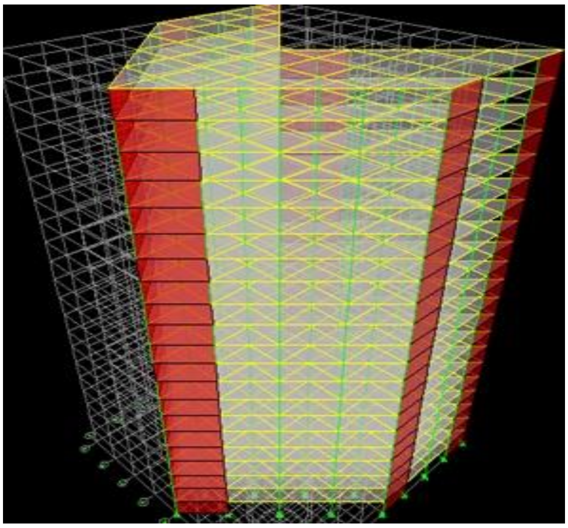

Fig.6 model 2

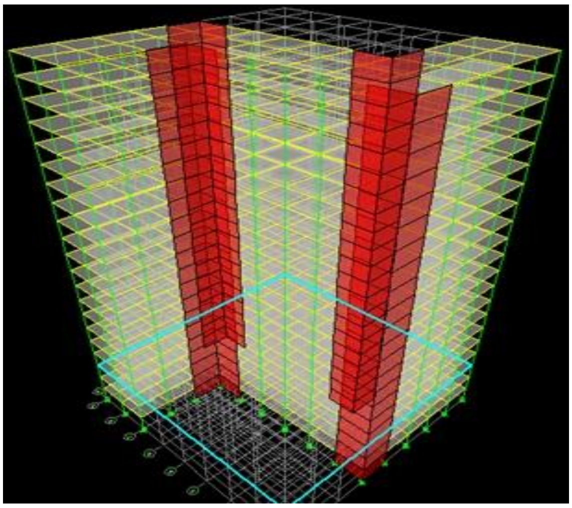

Fig.7 model 3

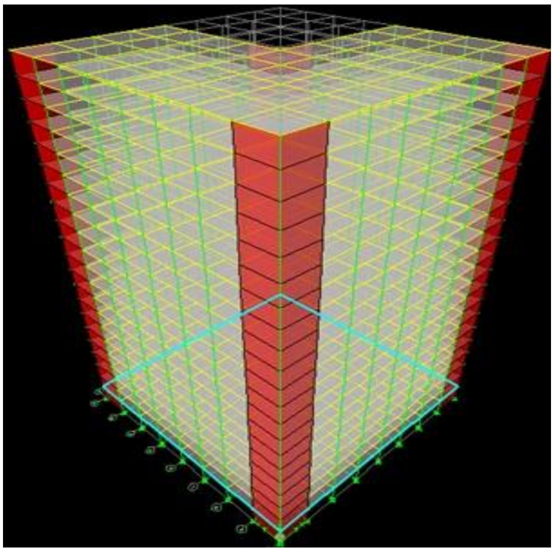

Fig.8 model 4

5. LOAD CONSIDERATION

Dead load:

The self weight of the structure (dead load) obtained from the Indian code IS 875 (section 1)-1987, table 1. Unit weight of the concrete is varies from 24.80 KN/m³ to 26.5 KN/m³. In this project unit weight of the project is considered as 25 KN/ m³. The self-weight of the basic segments are according to the accompanying.

Imposed load:

The imposed load are also called as live load, live load is nothing but variable or moving loads. It is mainly due to the occupants, furniture, temporary stores…etc. Except dead load all other loads considered as imposed loads. Live load is taken from the table 1 of IS 875(part 2) - 1987.

Live load=3 KN/m²

Seismic Load:

Assume that the considered structure is located in Zone-II TO Zone-V according to the code of practice IS 1893–2002. The element will be taken from the Table 2. Importance factor for the same structure will be taken as 1 according to IS 1893 –2002 of table6.Seismic design is done in accordance with IS: 1893:2002. This RC framed building is located in all Seismic Zones. The parameters to be used for analysis and design are given below as per IS: 1893.

DETAILS	ZONE 2	ZONE 5
R	3	3
I	1	1
Z	0.10	0.36
Sa/g	Type2	Type2

6. RESULT AND DISCUSSION

6.1 STATIC ANALYSIS

Lateral displacement

Displacement is the moment of the structure from its original position, in Zone 2 displacement will be decreased, by introducing shear wall at corner. Although the consequences every models the greatest displacement is in FIRST model and least displacement will be occurred in SECOND model respectively.

Storey drift

The storey drift is most extreme in FIRST model and minimum is in SECOND and THIRD model.

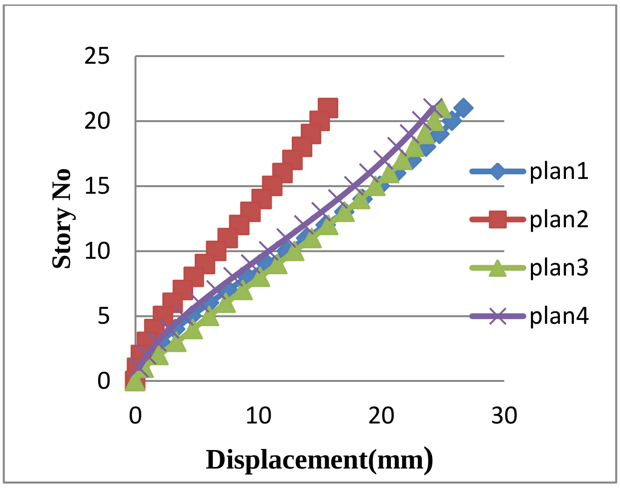

Fig.9 Storey displacement graph for zone II

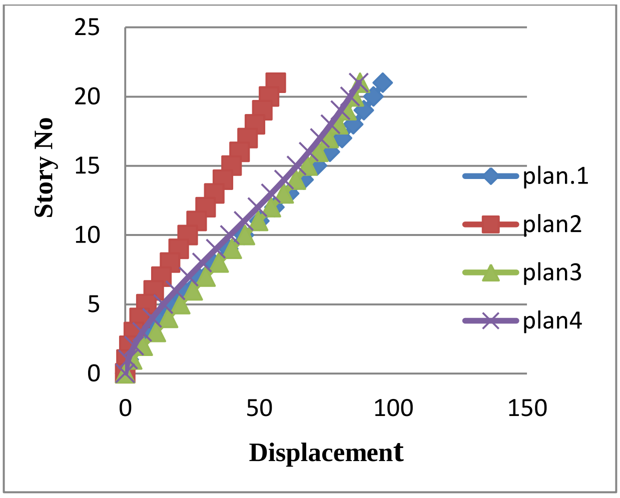

Fig.10 Storey displacement graph for zone V

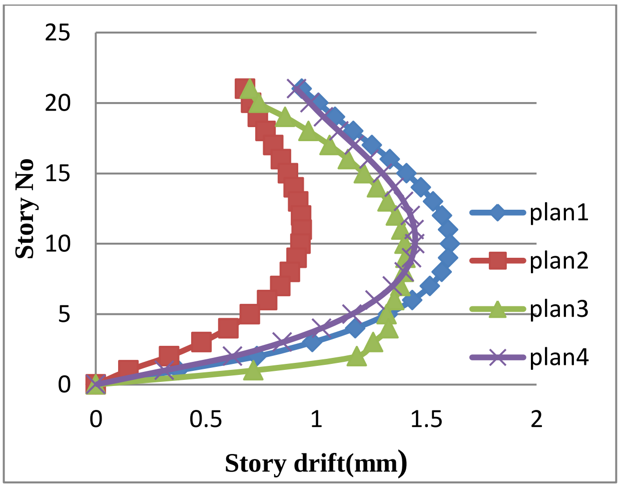

Fig.11 Storey drift graph for zone II

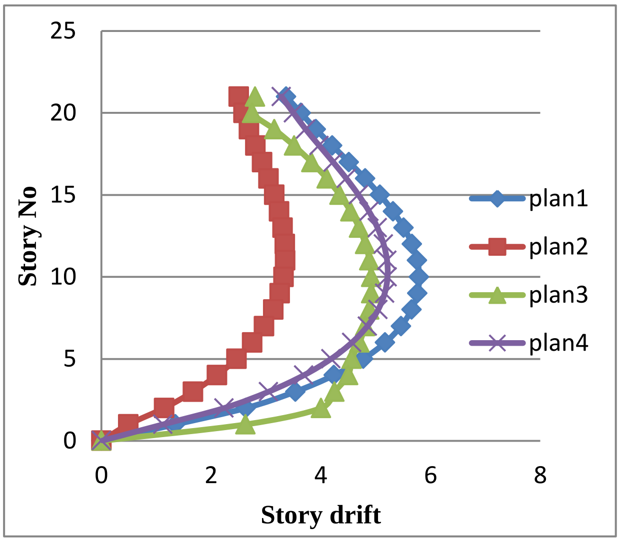

Fig.12 Storey drift graph for zone V

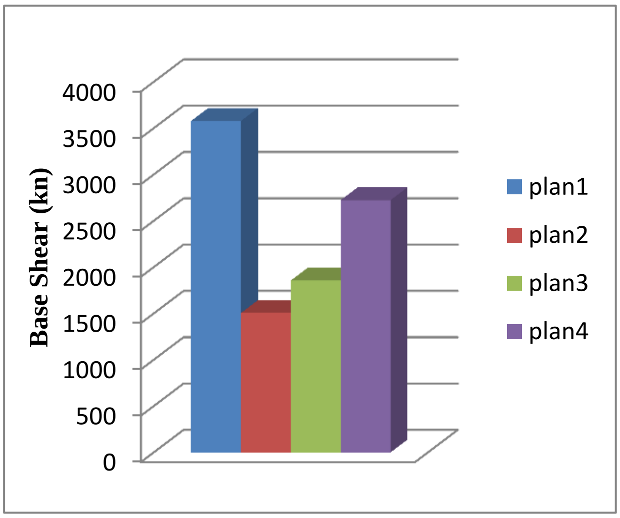

Fig.13 Base shear graph for zone II

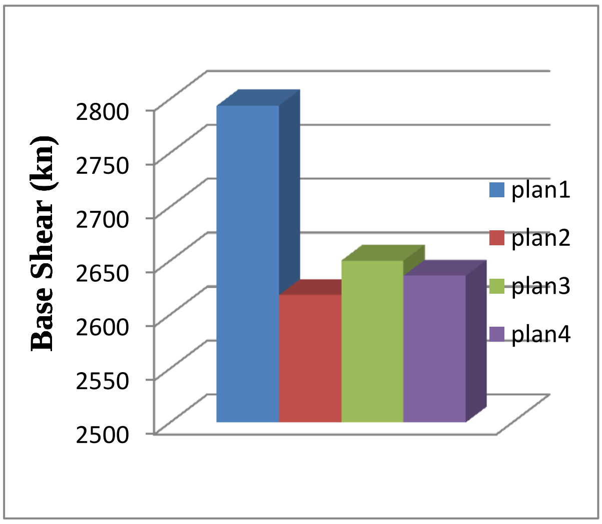

Fig.14 Base shear graph for zone V

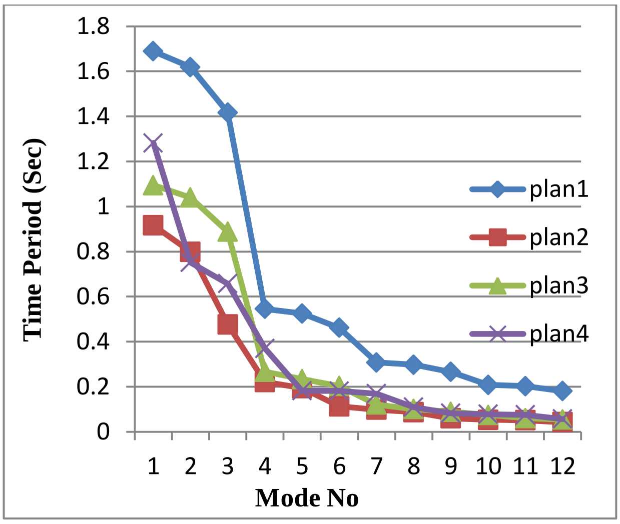

Fig.15 Time period graph

6.2 RESPONSE SPECTRUM ANALYSIS

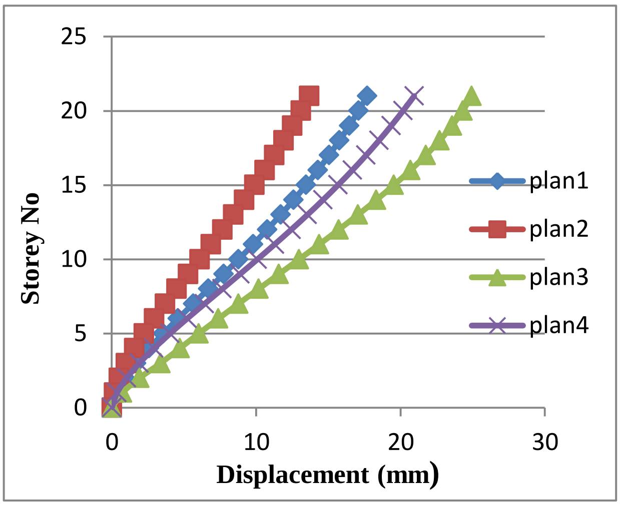

Fig.16 Storey displacement graph for zone II

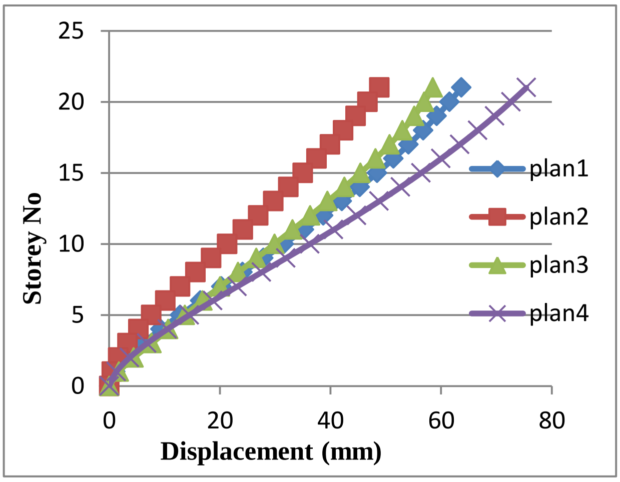

Fig.17 Storey displacement graph for zone V

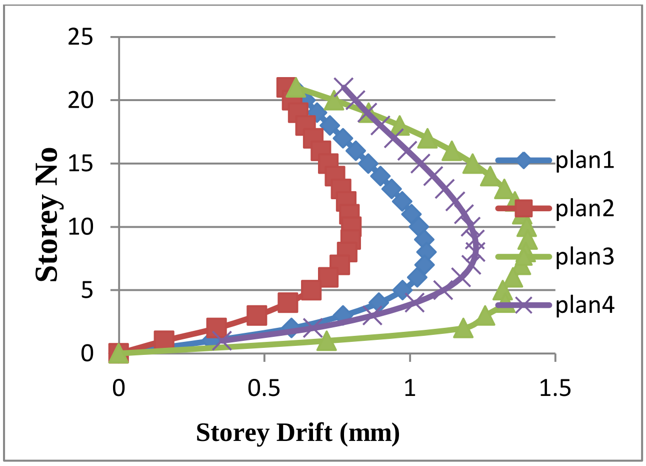

Fig.18 Storey drift graph for zone II

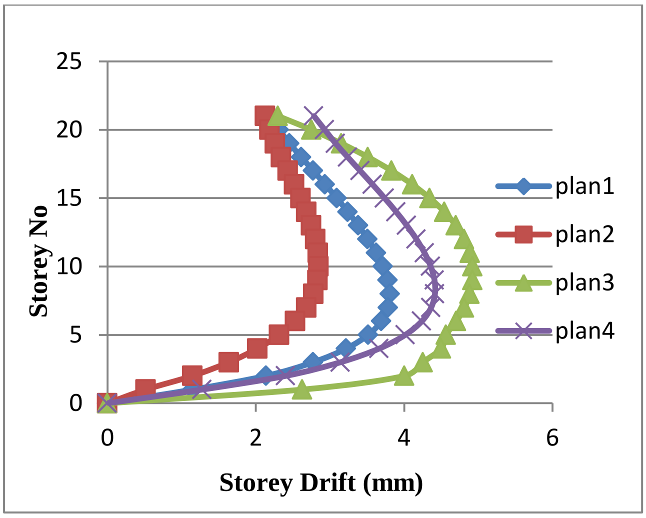

Fig.19 Storey drift graph for zone V

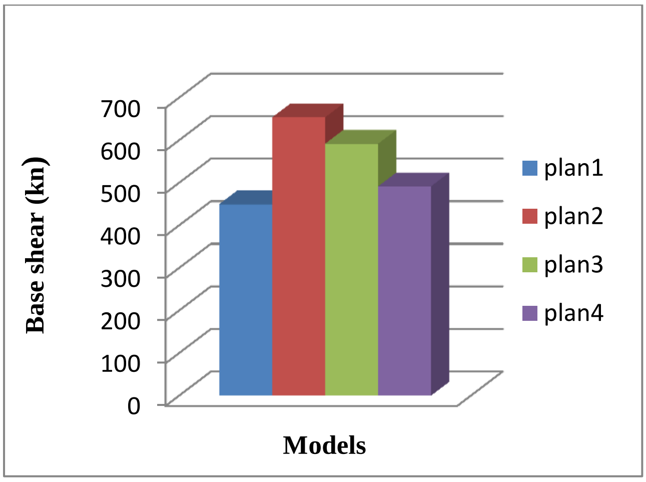

Fig.20 Base shear graph for zone II

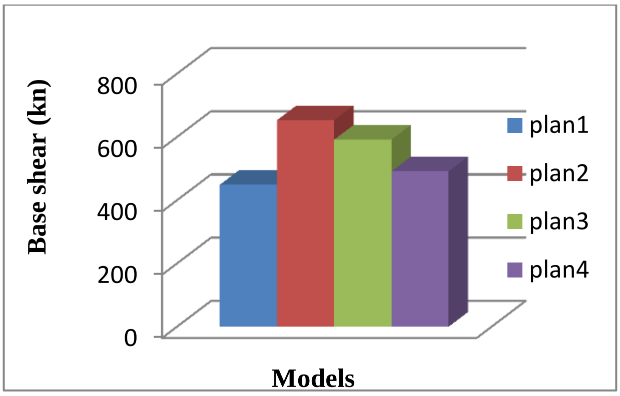

Fig.21 Base shear graph for zone II

7. CONCLUSION

Storey Displacement and Storey Drift

- From the observation of the obtained results, the storey displacements in both equivalent and response spectrum method of analysis the FIRST model representing the maximum result, and the second model showing the best minimum results in both horizontal and vertical directions compared with all the models in two zones.
- The storey drifts in both equivalent and response spectrum method of analysis the FIRST model representing the maximum results, and the SECOND model showing the best minimum result, in both horizontal and vertical directions compared with all the models in two zones.
- The structural storey displacement is decreased due to the increase of stiffness of the structure, and including with the decrease of the velocity and acceleration of the structure.
- By introducing the SECOND model we can reduce maximum velocity and as well as acceleration of the structure and in addition we can get the good accurate result of the structure.
- From the result of all the models in both the zones, says that the shear wall location in the SECOND model is effective for resisting the seismic impact.

Base shear

- We can observe the maximum base shear in equivalent static method of analysis from the FIRST model and the minimum value of base shear in SECOND model.
- From the base shear results of response spectrum analysis, the maximum value of base shear we can see in the SECOND model hence it can give best results compare will all the shear wall positions of the models.

- Shear wall is the one of the most important structural element in the tall structure, for resisting the lateral forces like quake and wind loads.
- If the construction of the shear wall dimension is large then it will take the large lateral loads existed by quake or wind loads.

Time Period

- From the above description we can observe that, the maximum time period produces the FIRST model and least period in the model SECOND.
- The time period is same for all the models in this study, because all the models have the same characteristics.

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