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COMPARISON OF UNIT ASPECT RATIO FOR G+10 STOREY BUILDING WITH DIFFERENT FOUNDATION DETAIL

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Abstract — *A large proportion of world's population lives under higher seismic risk region so there is a need of construction technologies which resist higher seismic forces and Shear wall and Base-isolation are such type of technology Base isolation system for building is introduced to decouple/isolate the superstructure of the building from potentially damaging due to earthquake motion and Shear wall stabilise the whole structure against the effect of strong horizontal seismic loading.. The main goal of this research is to find out the behaviour of the G+10 Storey building in different types of Foundation detail . 8 different foundation cases checked for the G+10 storey building. The Building dimensions were restricted by Building aspect ratio (H_B/L_B). The response spectrum analysis of the G+10 storey building in different 8 foundation detail cases using ETABS® software. At the end, building response parameters time-period, Roof displacement, Base displacement and Absolute displacement was compared.*

Keywords- *Shear wall, Base-isolation, Unit Building Aspect Ratio, Shear wall Aspect Ratio, Different Foundation detail, Different Response Parameters.*

I. INTRODUCTION

Earthquakes are perhaps the most unpredictable and devastating of all natural disasters. They not only cause great destruction in terms of human casualties but also have a tremendous post-occurrence impact on affected areas. The overwhelming increasing population is the requirement of high rise building. A seismic isolation system is designed to separate a structure from its foundation soil at the time of an earthquake so that the size of external load on the structure is reduced by increasing the natural period of a structure through artificial means using seismic characteristics –strong short-period properties and weak long-period properties. Cases of application of such a system at general structures.

In this paper we will study about seismic behavior in different foundation cases of G+10 storey building, in this paper the measuring response parameters for G+10 storey of building are top story drift is taken, the models are prepared and analyzed in Matrix based analytic software. To performed seismic analysis on model response spectrum method used.

II. PARAMETRIC STUDY

To effectiveness of different foundation cases building is checked for G+10 storey. Here for unit aspect ratio R=1 different foundation cases G+10 storey building effectiveness is checked by comparing response parameters. As the tendency (purpose) of different foundation detail checked how to behaviour of building against seismic forces is to compare time period, roof displacement, base displacement and absolute displacement. Building data are same as mentioned. Eight different foundation cases of building model analysing the model in ETABS by using response spectrum analysis.

Building Data

Grade of concrete = M 25
Beam size (m×m) = 0.4×0.5
Column size (m×m) = 0.5×0.5
Thickness of slab = 0.2 m
Thickness of shear wall = 0.25 m
Storey Height = 3.5 m each
Bottom storey height = 2 m
Live load = 2 kN/m^2
Dead load on slab = 1 kN/m^2
External wall load = 16.10 kN/m
Internal wall load = 8.05 kN/m
Parapet wall load = 2.3 kN/m

Table 1 Geometrical data of Buildings

Story	Height of building (H_B) (m)	R=1 (H_B/L_B=1)	
		Length of building (L_B) (m)	Plan area of building (provided) (m^2)
G+10	40.5	40.5	40 X 40

Here for an unit aspect ratio G+10 storey building for different eight cases is modelled and compared.

Case 1 Fixed base building (without slab at plinth level)
Case 2 Fixed base building (with slab at plinth level)
Case 3 Base-isolation provided below G.F. level
Case 4 Base-isolation provided at G.F. level
Case 5 Fixed base building with shear wall Hw/Lw =10
Case 6 Fixed base building with shear wall Hw/Lw =20
Case 7 Building with shear wall Hw/Lw =10 and base isolation
Case 8 Building with shear wall Hw/Lw =20 and base isolation

Case 1 and Case 2

As a practical consideration, plinth level directly rest on soil and load directly transfer to it so there is no need of slab at that level. But in base isolated building at plinth level slab is generated to achieve rigidity, so for a comparison purpose in second case the slab is modelled in a fixed base building.

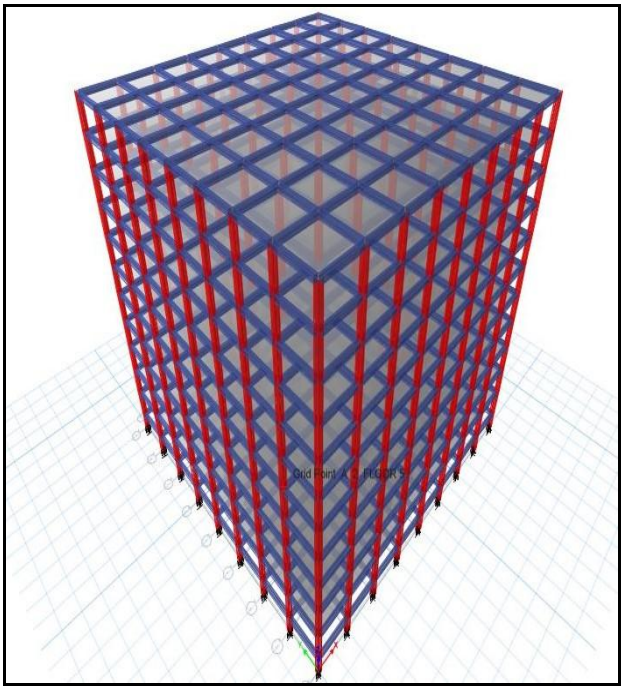

Figure 1 Fixed base building (without slab at plinth level)

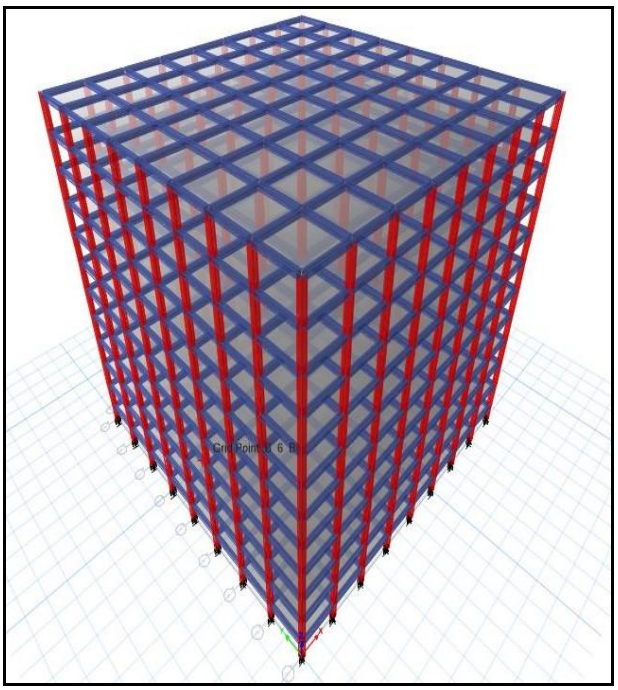

Figure 2 Fixed base building (with slab at plinth level)

Case 3 and Case 4

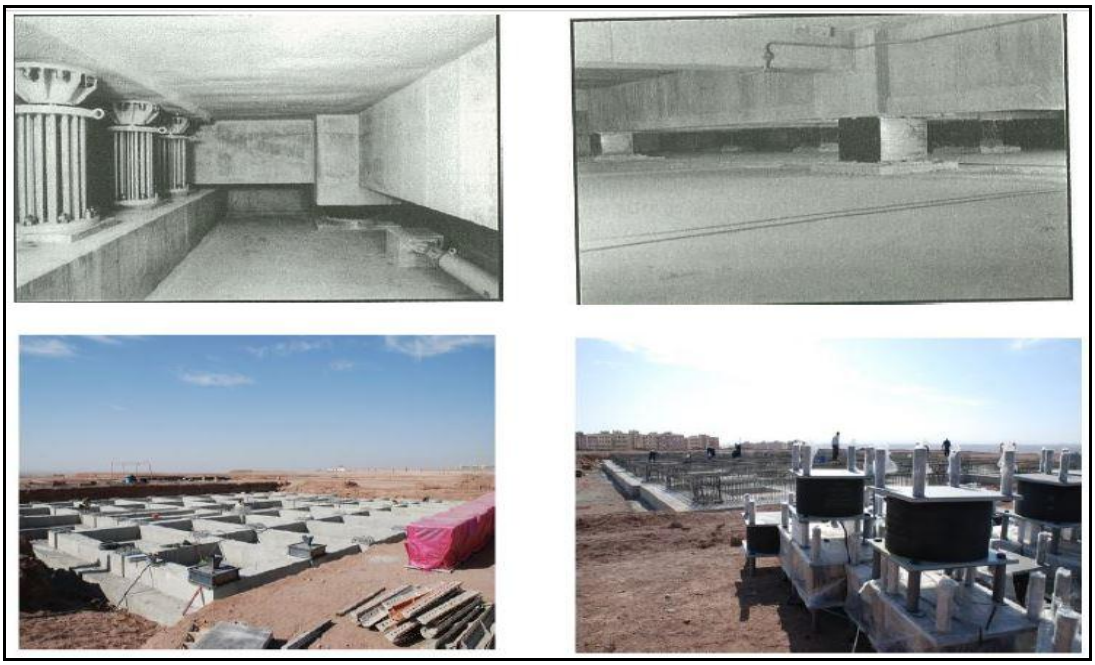

Figure 3 Provision of Base-isolation

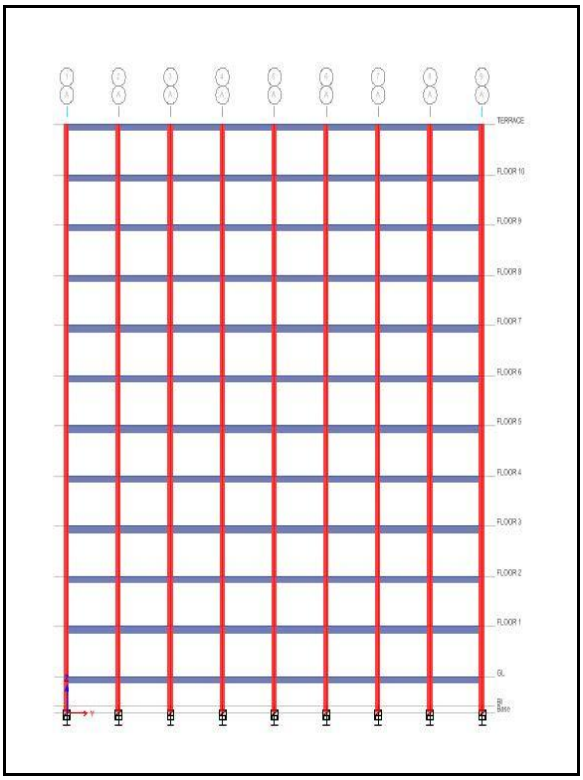

Figure 4 Elevation Base-isolation provided below G.F. level

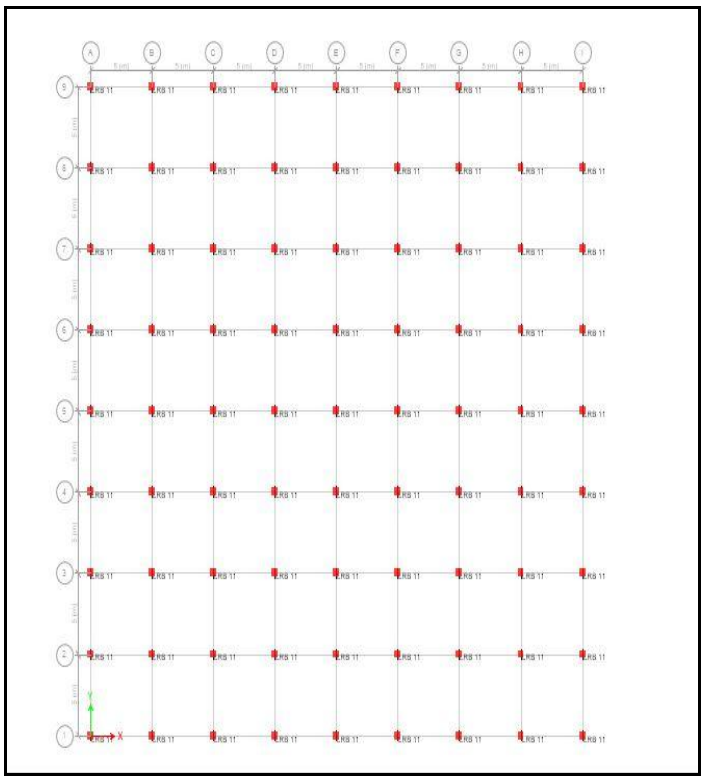

Figure 5 Plan Base-isolation provided below G.F. level

Base-isolation can be provided below G.F. level or at G.F. level. Base-isolation below G.F. level supported by tie beam section and that basement can be used as a utility tunnel. For a second case base isolation provided at G.F. level base isolation rest on pedestal.

Case 5, Case 6, Case 7, Case 8

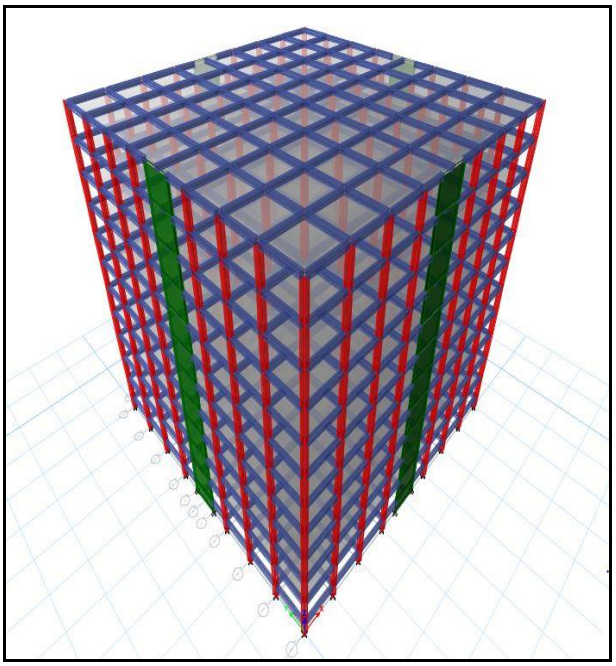

Figure 6 Fixed base building with shear wall Hw/Lw =10

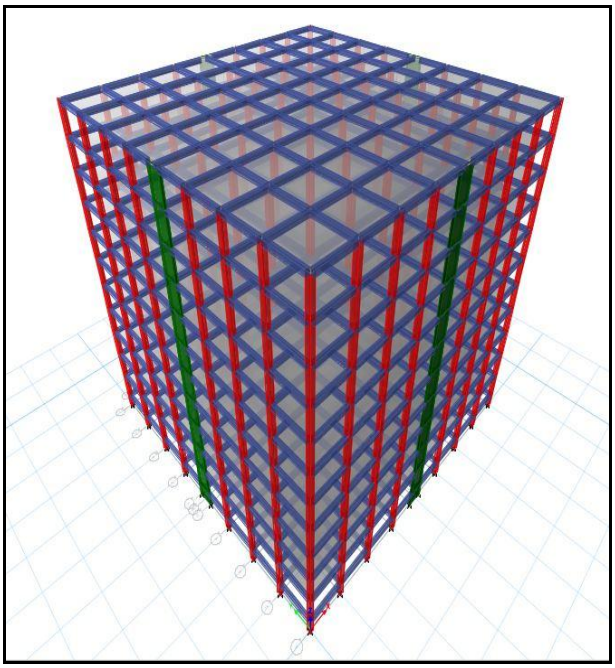

Figure 7 Fixed base building with shear wall Hw/Lw =20

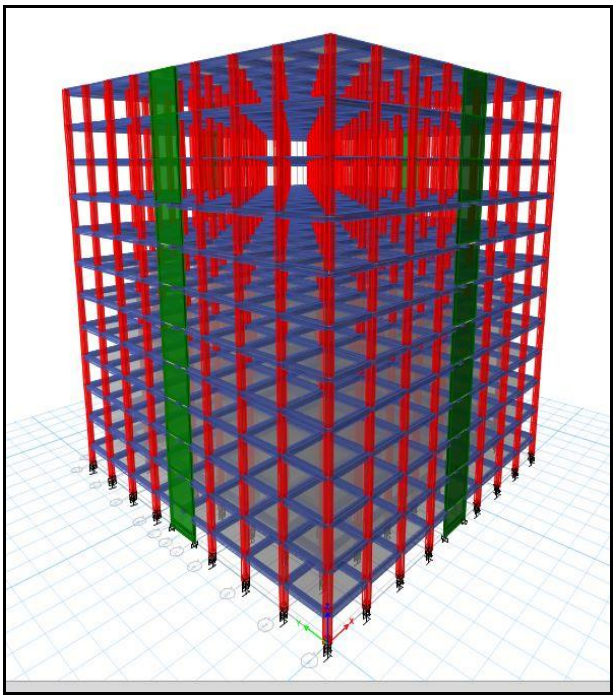

Figure 8 Building with shear wall Hw/Lw =10 and base isolation

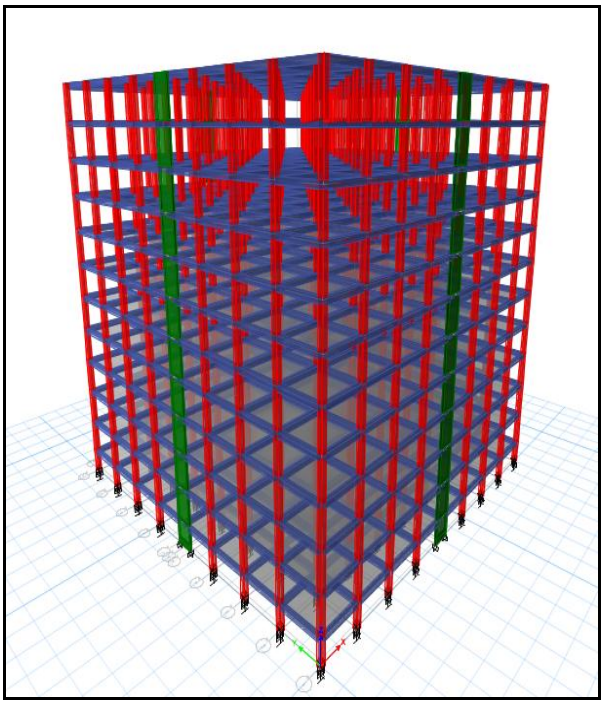

Figure 9 Building with shear wall Hw/Lw =20 and base isolation

III. RESULT

After analysing eight different cases the various parameters time period, roof displacement, base displacement and absolute displacement are compared in Table 2 and graphs are generated for same.

Table 2 Comparison of different parameters G+10, R=1

Parameters	Fixed	Fixed with slab at plinth	SW 10	SW 20	BI below G.F.	BI at G.F.	SW 10+ BI	SW 20+ BI
Time Period(s)	2.397	2.397	2.12	2.324	2.414	2.384	2.15	2.356
Roof Dis.(mm)	10.87	11.87	10.11	10.40	11.06	10.76	10.35	10.71
Base Dis.(mm)	0	0	0	0	5.53	5.16	5.30	5.23
Absolute Dis.(mm)	10.87	11.87	10.11	10.40	5.53	5.60	5.05	5.48

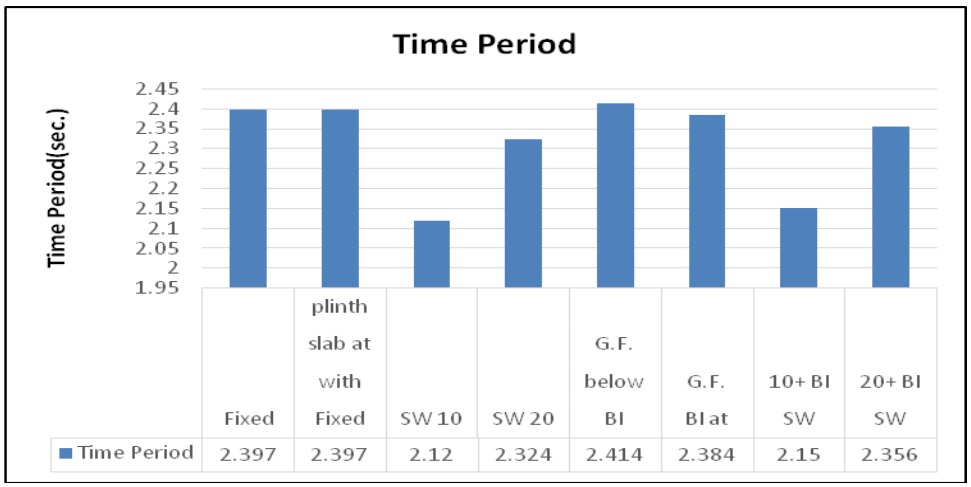

Figure 10 Time period

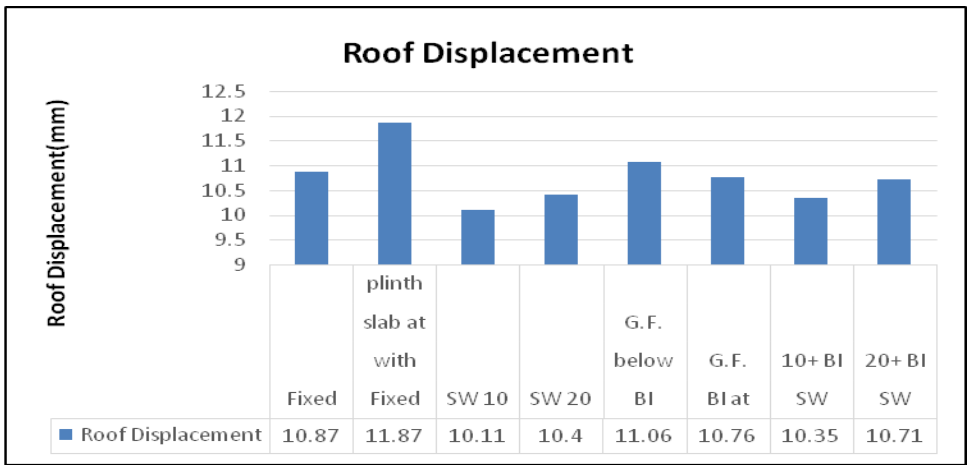

Figure 11 Roof Displacement

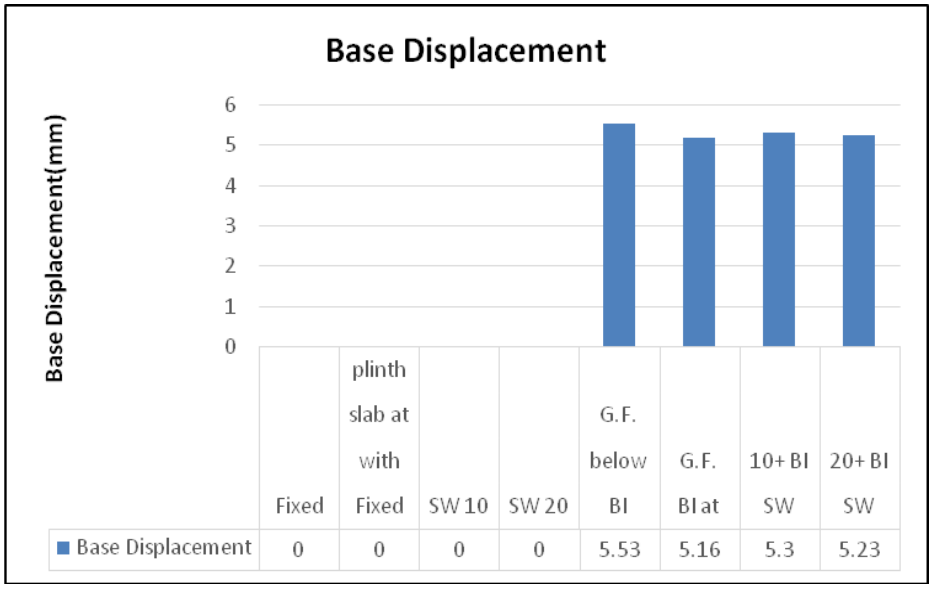

Figure 12 Base Displacement

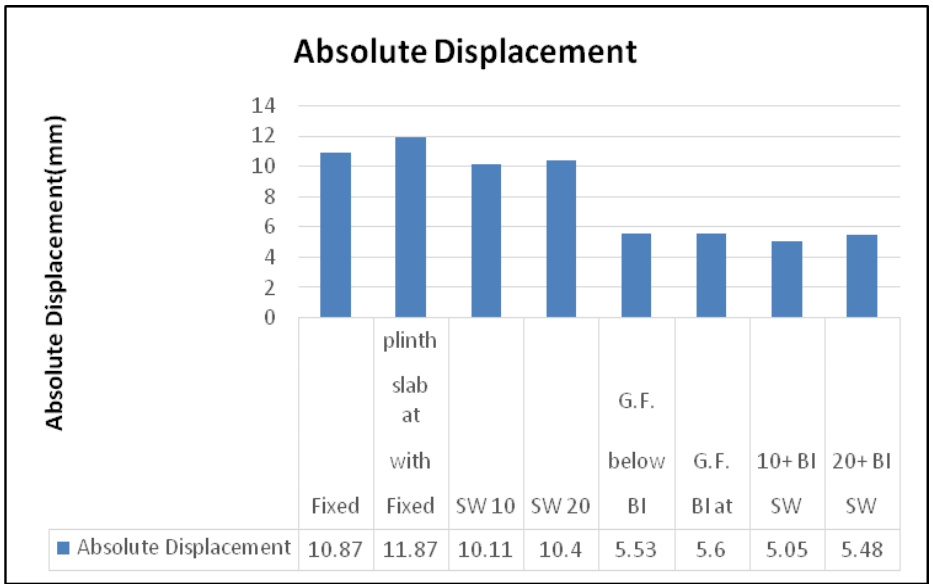

Figure 13 Absolute Displacement

IV. CONCLUSIONS

Time period

I. Time period of fixed base building with slab at plinth level and without plinth level remain same.

II. Since shear wall induces stiffness the time period of shear wall building is decreased. As in Hw/Lw =10 case length of wall is higher than Hw/Lw =20 the time period for Hw/Lw =10 (13 %) is decreases at higher rate.

III. As base isolation includes flexibility in a building the time period compared to fixed base building is increased by 65%. The percentage increase in time period for base isolation at base and base isolation at above basement column remain almost same.

IV. For building with shear wall (Hw/Lw =10,20) along with base isolation time period is between fixed base building and base isolated building.

Roof Displacement

I. The roof displacement difference in fixed base building with slab at plinth level and without plinth level is only about 3% so as practical consideration there is no need of slab at plinth level.
II. Same as for base isolation case in both type configurations the roof displacement remain almost constant so base isolation can be directly provided at top. Base isolated building increase the displacement by 17 to 20 % with comparison of fixed base building.
III. As property of shear wall roof displacement is decreased in building with shear wall model. Inducing shear wall in a base isolated building decreased roof displacement by 8-10%.

Base Displacement and Absolute displacement

I. In base isolated building as base is free to move it gives displacement at base. Inclusion of shear wall decreases the base displacement by 3 to 4%.
II. Absolute Displacement is the difference of displacement at roof and base of building.
III. Building with shear wall along with base isolation the absolute displacement (overall deformation) is lower in almost same range of time period as base isolation.

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