Response Spectrum Analysis of Large spans lab In Horizontal setback Building

Deepesh Goyal[1], Rahul Sharma[2]
[1]Dept of Civil Engineering
[2] Associate Professor, Dept of Civil Engineering
[1, 2] PITSUjjain, M.P., India

Abstract- *Demand for skyscrapers is increasing day by day. Mainly used for residential and commercial building sit supports a wide range of requirements. Great option for large span architects needed for flat slabs, waffle slabs and rib slab studs if you want to cover an opening in a larger building with as little support as possible. The use of different types of panels has become a new trend and is becoming a major challenge for structural engineers. Therefore, you need to study it structural behavior. This project will be carried out under Seismic Zone III in the seismic analysis on the G + 9th floor Building. In this study, four different types of long-span C-shaped (horizontal setback building) slab structures are modeled.10-story building, i. H. A G + 9-story building with a height of 3.50 meters on each floor is modeled and analyzed. Everyone's plan area the four buildings are the same. H. 2859 square meters each (49.50 m x 82.50 m). These buildings were designed accordingly India's implementation standards for seismic design of buildings. The base of the building has been fixed. The square sectionUsed for structural elements. The height of the building is considered constant throughout the structure. The building ismodeled in ETABSvr.2016*

Keywords: large spans lab, ETABSvr.2016, Horizontal Set back Building, Flat slab, Waffles lab and ribbeds lab

I. INTRODUCTION

Governments Buildings with horizontal receding tend to be severely damaged during seismic excitation due to the flexibility of the soil in the plane, which affects performance in two ways. Second, it causes excessive stress concentration in the reentrant corners. The recoil structure is very vulnerable to earthquakes due to its vertical shape and mass irregularities, but it is even more vulnerable if the structure also has rigid irregularities. If a structure is on sloping terrain, the risk factors for that structure may increase. In this work, we evaluated the seismic performance of the regression structure standing on the slopes of hills with flat ground and soft stock composition. The analysis was performed by three different methods: equivalent static force method, response spectrum method, and time domain method, and the extreme response of the inverted building per floor was recorded. To reduce this soft fold effect and overreaction, three

Different mitigation techniques were applied and the best solution from these three techniques was presented. The horizontal retreat of the building also enhances the impact of the building by using different types of panels. Panels are typically designed to provide a horizontal plane on the floors, roofs, bridges and other types of structures of buildings. Slabs are supported by walls or reinforced concrete beams, usually monolithically cast in slabs or supported by structural steel beams, columns, or floors. The base plate is used as a regular waffle, rib,and waffle plate.

II. OBJECTIVE

There are following objectives in this study project.

1) To study the behavior of various types of slab &connecting beam in a structure.
2) To Study the various past research based on use of various slabs and secondary beam.
3) To Modelled a G+9 multistory building under taking different variation on slabs & introduce a secondary beam in the Structure.
4) To compare a different models case to find optimized structure.
5) To analysis G+9 multistory building by RSA (Response Spectrum Analysis).
6) To assist the different parametric result such as Storey displacement, base shear, overturning moments, storey shears etc into it.

III. METHODOLOGY AND MODELLING

Modeling and analysis of this research is done in CSi ETABS software. For complex structural analysis, a software like CSiETABS helps in visualization of the structural model and also deprive the tedious calculation of the analysis results in complex structures like the structures under consideration in this study. The table 1 is explained the model cases used on in this project.

Table1:Model Description

S.No.	Model Description	Structure Description
01	Model 1	Building having Flat Slab with Drop Panels
02	Model 2	Building having Waffle Slab
03	Model 3	Building having Ribbed Slab
04	Model 4	Building having Secondary Beams

A. Structural & Material Properties

Table 2 and 3 enlist the structural and material properties respectively.

Structural Properties		
S.No.	**Descriptions Of Parameters**	**Dimensions/Comments**
A)	Common Parameters	
1	Structure type	Rigid frame Building
2	No of storey/total height	G+9/35.00m
3	Planarea	49.50mx 82.50m
4	Column size	600mmx 600mm
5	Spacing in grid in x–direction	8.25m.c/c
6	Spacing in grid in y–direction	8.25m.c/c
8	Individual storey height	3.50m.
B)	Model 1:Building Having Flat Slab with Drops	
1	Beam Size	No beams
2	Slab Thickness without Drop	285mm
3	Slab thickness with Drops	360mm
4	Drop Size	3.00mx 3.00m
5	Thickness of Drops	75mm
C)	Model 2:Building Having Waffle Slab	
1	Beam Size	400mmx 700mm
2	Slab Thickness	150mm
3	Overall Slab thickness	450mm
4	Stem Width	250mm
5	Spacing of Stems in X-Direction	1500mmc/c
6	Spacing of Stems in Y-Direction	1500mmc/c
D)	Model 3:Building Having Ribbed Slab	
1	Beam Size	400mmx 700mm
2	Slab Thickness	150mm
3	Overall Slab thickness	450mm
4	Stem Width	250mm
5	Spacing of Stems in X-Direction	1500mmc/c
E)	Model 4: Building Having Secondary Beams	
1	Beam Size	400mmx 700mm
2	Slab Thickness	150mm
3	Secondary Beam Size	250mmx 400mm
5	Spacing of Beams in X-Direction	2000mmc/c

Table3: Material Properties

Material Properties		
S.No.	**Types of material**	**Dimensions/comments**
1	Concrete(beam & column)	M-30
2	Concrete(Slab)	M-25
3	Grade of rebar (R/F)	HYSD-500

Figure 1 and figure 2 represent the Plan and 3-D view of the Model 1 & 2. Figure 3. to figure 4 depicts the plan and 3d of each model similarly.

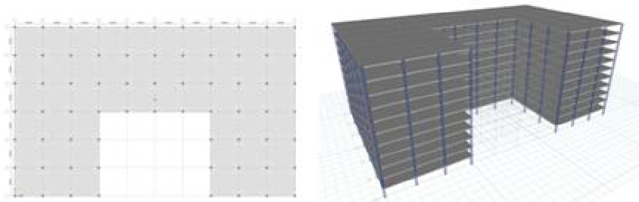

Fig.1:Model1:BuildingwithFlatSlab: Plan &3Dmodel

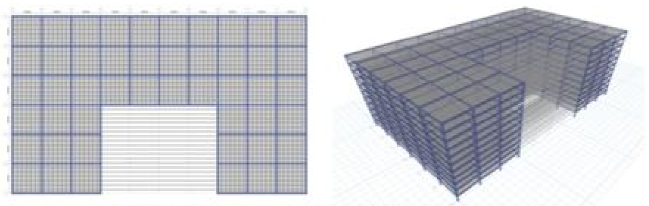

Fig.2:Model2Buildingwith WaffleSlab: Plan &3Dmodel

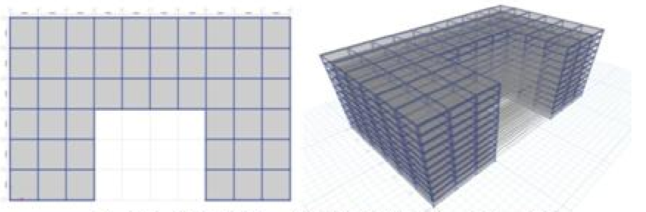

Fig.3:Model3:Building withRibbed Slab: Plan &3Dmodel

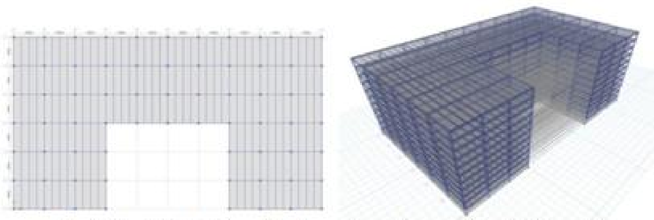

Fig.4:Model4:Buildingwith SecondaryBeams: Plan &3Dmodel

IV. RESULTS AND DISCUSSION

Based on the modelling the lists out results are taken from the software analysis of all four models with the concept of horizontal setback approach. The results areas follows:

A. StoreyDisplacement

Deflection of the stories from the initial position is termed as storey displacements and its maximum value is obtained at the topstorey. The values of storey displacements in X and Y directions obtained from the analysis has been shown in table and table respectively, while graphical representation is described in fig 5 and fig 6 for X and Y direction respectively. Table 4 and 5 show the storey result in x and y Direction.

Table4: Storey Displacement in X-Direction (mm)

S.No.	**Stories**	**Model1**	**Model2**	**Model3**	**Model4**
1	G+9	125.641	82.874	67.02	71.603
2	G+8	121.142	80.122	64.596	68.604
3	G+7	113.991	75.47	60.935	64.08
4	G+6	104.35	69.191	56.324	58.361
5	G+5	92.663	61.626	50.974	51.71
6	G+4	79.396	53.086	45.068	44.352
7	G+3	64.977	43.844	38.762	36.486
8	G+2	49.793	34.13	32.192	28.28
9	G+1	34.242	24.143	25.46	19.881
10	G+0	18.947	14.098	18.599	11.477
11	Ground	5.599	4.632	11.082	3.678

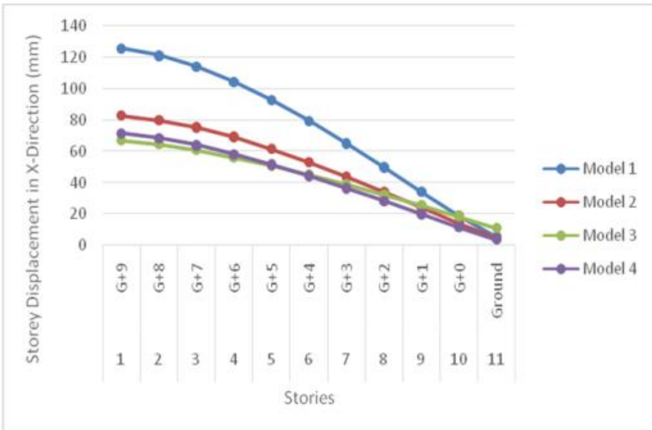

Fig5:Storey Displacement in X-Direction

Table5:Storey Displacement in Y-Direction (mm)

S.N.	Stories	Model1	Model2	Model3	Model4
1	G+9	125.828	83.66	76.382	71.106
2	G+8	121.298	80.82	73.58	68.078
3	G+7	114.115	76.079	69.388	63.552
4	G+6	104.444	69.709	64.099	57.852
5	G+5	92.73	62.053	57.954	51.235
6	G+4	79.439	53.423	51.163	43.929
7	G+3	64.999	44.095	43.909	36.127
8	G+2	49.798	34.303	36.343	27.998
9	G+1	34.236	24.247	28.577	19.688
10	G+0	18.936	14.141	20.612	11.377
11	Ground	5.593	4.636	11.807	3.657

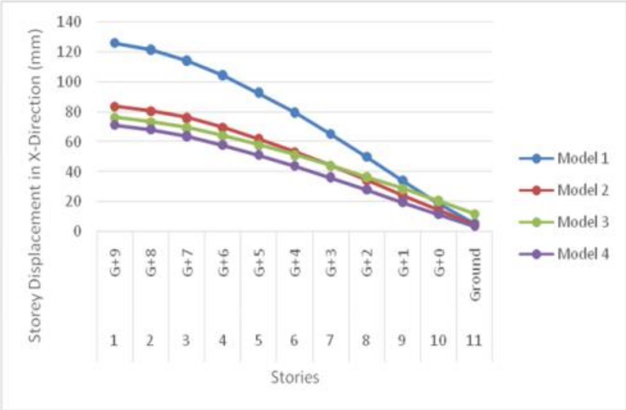

Fig6:Storey Displacement in Y-Direction

From above representation it is clear that the Storey displacement is nearly equal in both the direction i.e. X and Y for all the models. Model 1 (Building having Flat Slab with Drop Panels) shows higher storey displacement than other models and lowestvalue of storey displacement has been obtained in Model 3 (Building having Ribbed Slab) and Model 4 (Building having Secondary Beams).

B. Base Shear and Overturning Moment

Maximum shear force at the base of the structure is termed as base shear. Similarly the moment at the base of the structure is known as overturning moment. Both the quantity depends on the magnitude of lateral forces and dead weight of the structure. Based on the analysis results base shear and overturning moments are shown in table 4.3.

Table6: Base Shear and Overturning Moment

S.N.	Model	Fx(kN)	Fy(kN)	Mz(kN-m)
1	Model1	13501.30	13487.39	610205.92
2	Model2	19132.77	19037.14	864381.30
3	Model3	13981.33	12339.74	560285.76
4	Model4	13574.61	13713.20	622647.78

Bar chart representation of base shear and overturning moment is shown in Fig 4.3 and 4.4 respectively.

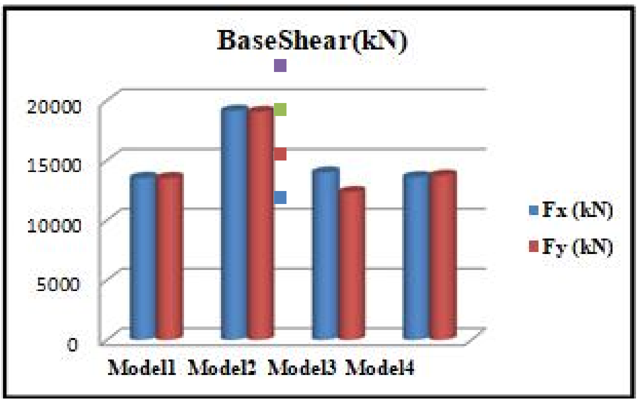

Fig7: Bar chart comparison of Base Shear

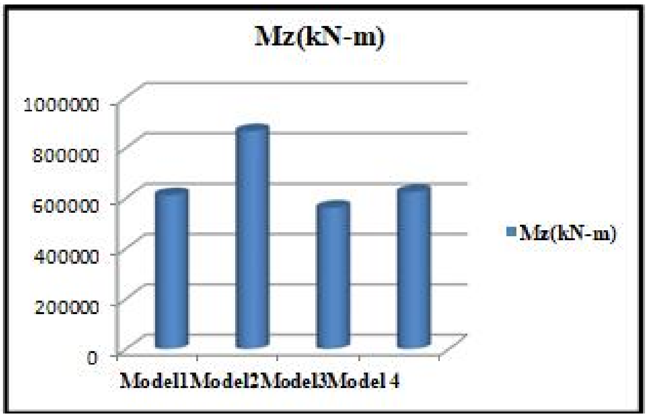

Fig8:Barchart comparison of Overturning Moments

Model 2 depicts higher base shear in both the direction as well as overturning moments in Z-direction. Model 1 and Model 3 shows lowest base shear in x-direction and Y-direction respectively.

C. Storey Acceleration

Storey Acceleration is a dynamic perimeter for the seismic analysis of structures, which shows the acceleration of building under dynamic seismic loading. Table 4.4 shows the value of acceleration for different cases under consideration in this study. Fig 4.5 depicts the bar chart representation of the structures.

Table 4.3: Storey Acceleration (mm/sec^2)

S.N.	Model	Acceleration		
		Ux	Uy	Uz
1	Model1	203.32	460.14	29.10
2	Model2	299.63	674.16	16.76
3	Model3	321.03	738.37	18.83
4	Model4	331.73	738.37	24.46

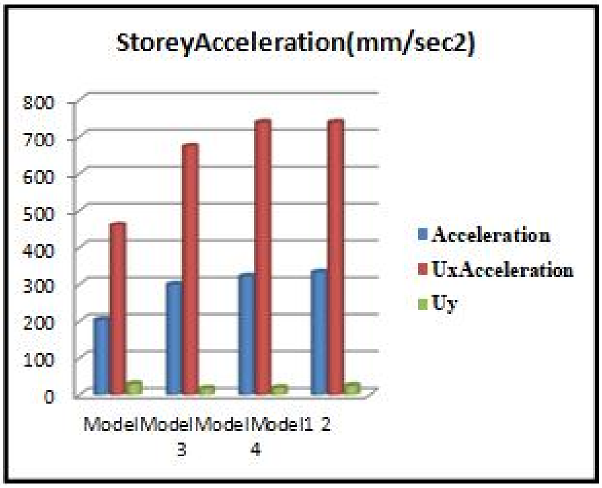

Fig 4.6: Storey Acceleration

Model 4 shows highest value of storey acceleration in all three directions while Model 1 shows lowest value of storey acceleration in X and y direction. In Z direction lowest value has been observed in Model 2.

V. CONCLUSION

On The basis of above study on “Seismic Response of Large span slab in Horizontal Setback Building” in which four cases of same storied and height structures has been taken under consideration as defined earlier, following results are concluded

A. Model 3 and Model 4 i.e. structures having ribbed slab and secondary beams show less storey displacement than other models.
B. Model 1 (Building having Flat Slab with Drop Panels) shows higher magnitude of storey displacement which is nearly 1.7 to 1.8 of Model 3 and Model 4.
C. Base shear and Overturning moments are nearly identical in Model 1 and Model 4 while Model 2 shows highest value of base shear and overturning moment which almost 1.5 times of the Model 1 and model 4.
D. Model 2 shows least storey accelartion amng all four structures while maximum storey acceleration is obtained in Model 4 which is nearly 1.5 to 1.6 of the lowest value.
E. Most preferable long span slab on the basis of this study is Building with Waffle or ribbed Slab.

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