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Seismic Analysis of Multistorey Building with and Without Soft Storey

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Abstract- To resolve the issues of parking in congested metropolitan cities, the concept of soft storeys can be adopted in high rise buildings. But, through the conclusion of this report, it can be found that using soft storeys in earthquake prone areas can make the entire structure less sustainable during an earthquake. For this project, a model of G+12 storeys was created and analysed for tall structure including soft storey for different levels using ETABS . More over ,for Zone 5 ,and other ten models were created and the performance of the structure was analysed by considering ground storey, ground and 1st storey, 3rd and 4th storey, ground and 6th storey , 6th storey , ground , 12th storey , 12th storey and ground, 1st and 2nd storey as soft storeys. To understand further the characteristic point the soft storey Equivalent static method and Response spectrum method has been used in this report.

1. INTRODUCTION

It is being considered a regular practice for building construction in India to have an opened first storey which are generally used for parking of vehicels and is known as soft storeys . Soft storey for a building can be opted if the stiffness of the level above the floor is 70% less or at an average of 80% stiff for above three floors.

In major construction projects, including residential , commercial and industrial building, a fr amed structure with infill walls are constructed.Those infill walls may be constructed of either concrete blocks or of clay bricks. During the design stage, these frame structures are usually considered as architectural component sand when the design is thorough and the load is distributed uniformly , the structure could with stand any seismic loads, if the design is in effective and load distribution is nonuniform then the structure could not stand stiff during an earthquake.

In numerous business and modern spots and further more in private structures, strengthened solid casings structures with brick work infill dividers are normally developed.Stone work inf ill is fundamentally comprised of dirt , block or solid squares dividers are introduced among shafts and segments of edge structures.in configuration process these boards are not favored and considered as structural parts.At the point when the infills are consistently dispersed in the structure and configuration is appropriately completed then they positively affect the seismic reaction of the structure.On the opposite side, the non uniform dissemination of the infill 's will have terrible impact or negative impact .

2. OBJECTIVES

- To study the behaviour of the G+12 building under the seismic zone V using ETABS 2013.
- Comparing the results analysed by linear static method and Response spectrum method.
- To obtain the results by providing the infill walls.
- To obtain the free space in the multistoreyed building for parking purpose.
- Obtaining the results from the analysis by providing with and without infill walls.
- To study the maximum displacement , drift and base shear from the tall structure located in earthquake zone.
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3. ANALYTICAL MODELLING

Model 1: Bare frame.
Model 2: Full infill.
Model 3: Full infill with ground floor soft storey.
Model 4: Full infill with ground floor &1st soft storey.
Model 5: Full infill with 3rd & 4th soft storey.
Model 6: Full infill with ground floor and 6th floor soft storey.
Model 7: Full infill with 6th floor soft storey.
Model 8: Full infill with ground floor and 12th floor soft storey.
Model 9: Full infill with 12th floor soft storey.
Model 10: Full infill with ground floor,1st& 2nd soft storey.

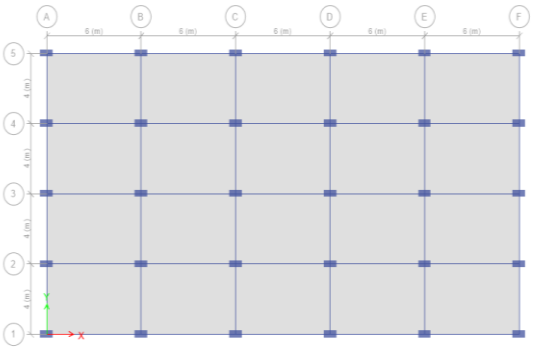


Fig1: Model 1

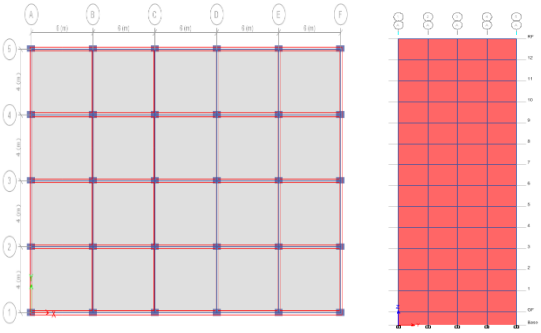


Fig2: Model 2

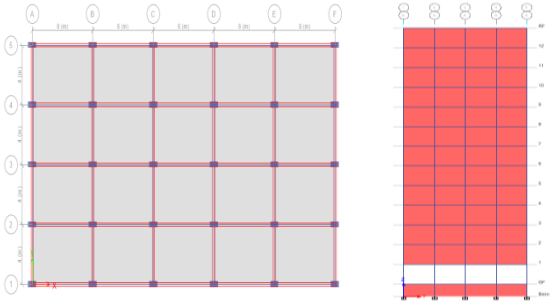


Fig3:Model 3

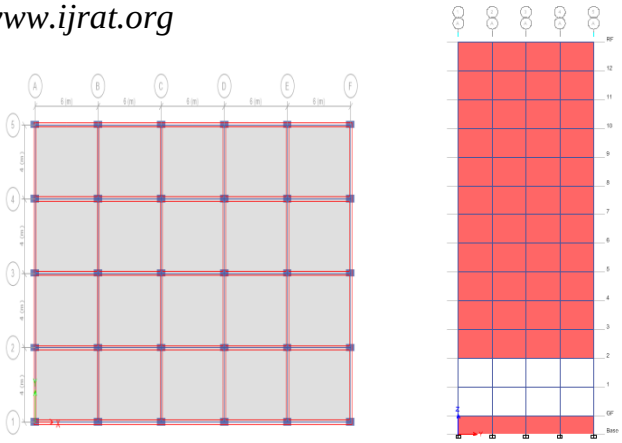


Fig4: Model 4

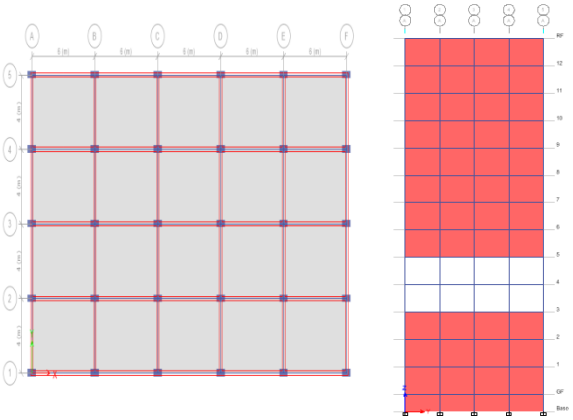


Fig 5: Model 5

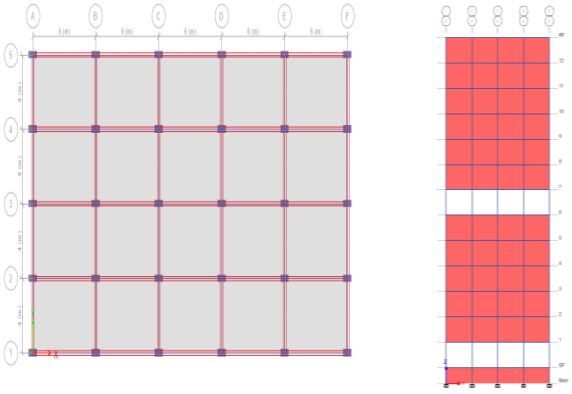


Fig6: Model 6

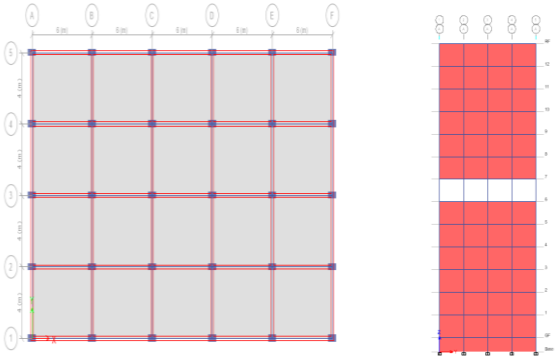


Fig7: Model 7

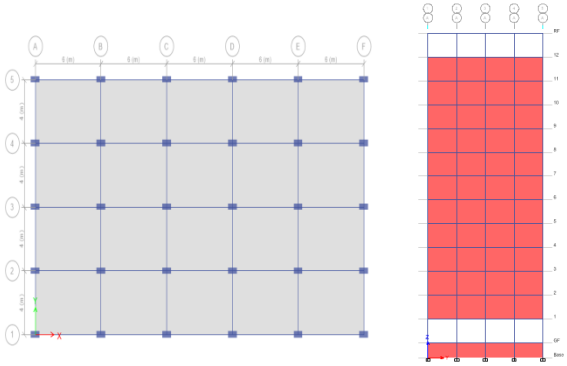


Fig8: Model 8

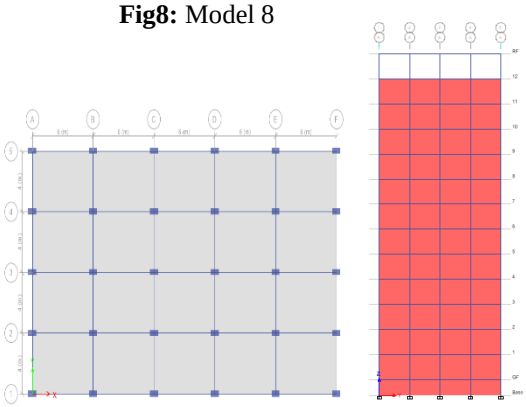


Fig9: Model 9

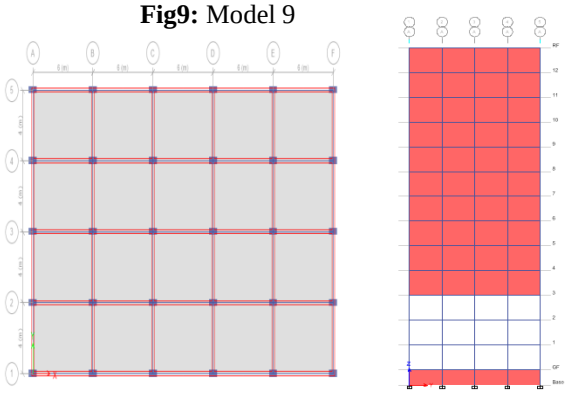


Fig10: Model 10

4. DESIGN DATA

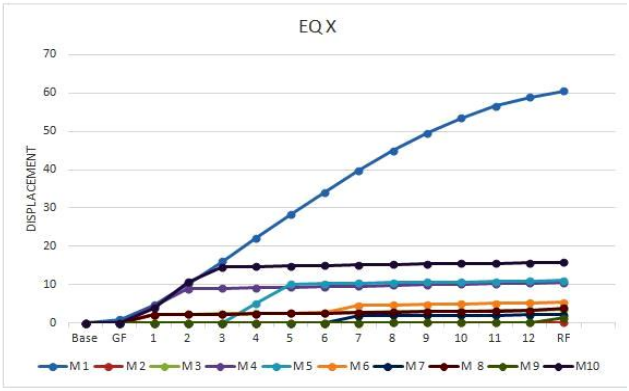
NO. of storey	G+12
Area	480m^2
Height of storey	3.2m
Characterstics of concrete	30N/mm^2
Characterstics of steel	500 N/mm^2
Column size	0.4m x 0.8m
Beam size	0.3m x 0.45m
Thickness of slab rcc slab	0.15m
Brick masonry wall thickness	0.23m
Density of R.C.C	25 KN/m^2
Poissons ratio	0.2
Density of Red brick	18 KN/m^2
Live load	4KN/m^2
Floor finish	1KN/m^2
Wall load	3.2-0.6(18X0.23)=10.764
Paraphet	1.8KN/m^2
Seismic zone	V
Reduction factor	5
Importance factor	1
Soil type	Medium

5. RESULTS

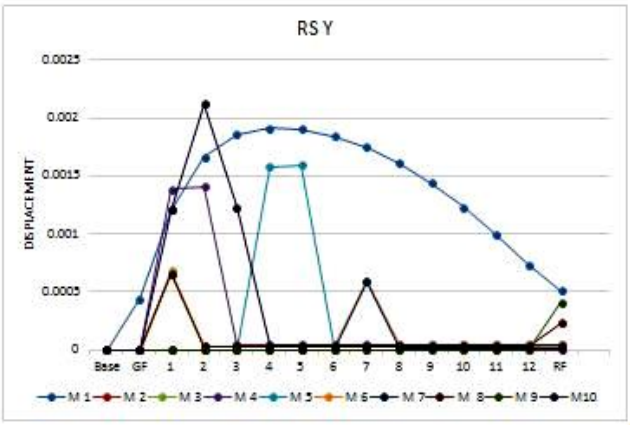
The analysed results of the study which is obtained from the linear static method and response spectrum method are listed below which are maximum displacement, story drift , time period and base shear.

5.1 STOREY DISPLACEMENT

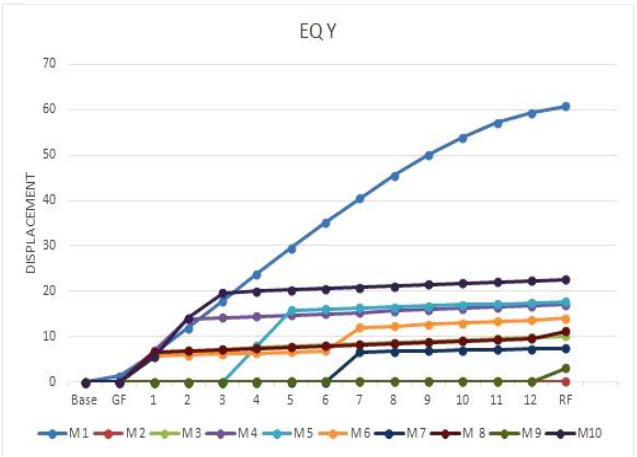
Storey Displacement in X & Y Directions



Displacement of Model 1 to Model 10 (M1 to M10)



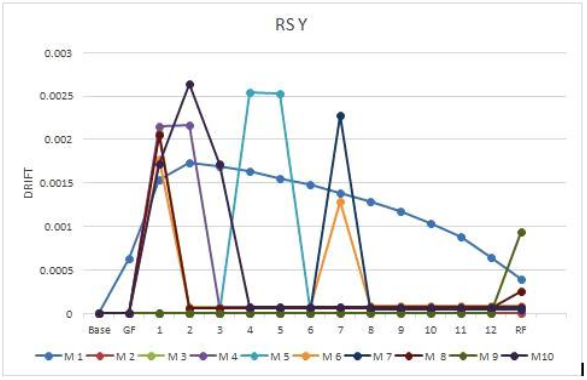
Displacement of Model 1 to Model 10 (M1 to M10)



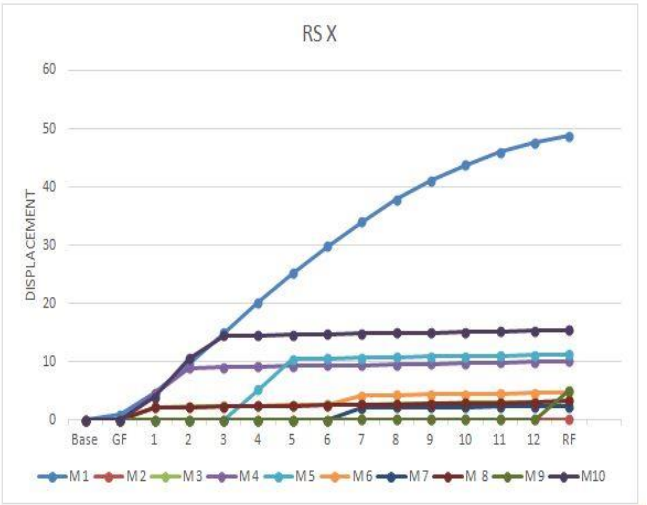
Displacement of Model 1 to Model 10 (M1 to M10)

5.2 STOREY DRIFT

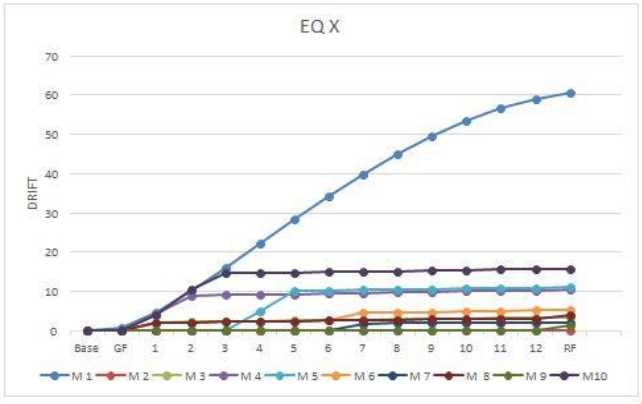
Storey Drift in X & Y Directions



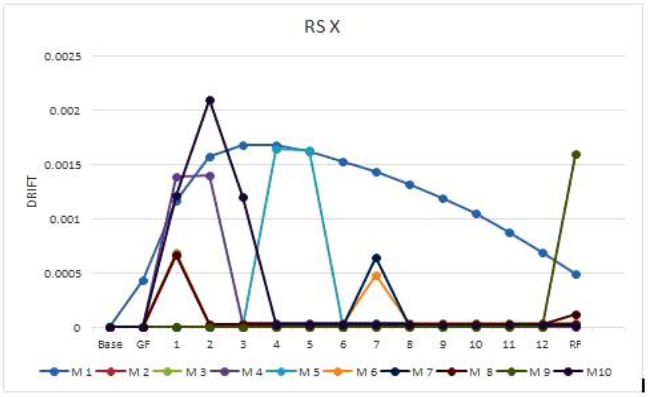
Storey Drift of Model 1 to Model 10 (M1 to M10)



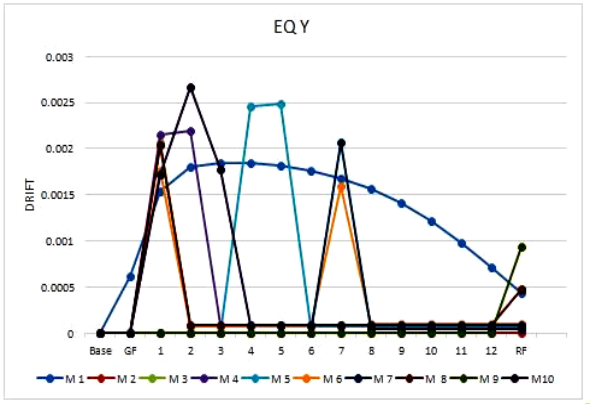
Displacement of Model 1 to Model 10 (M1 to M10)



Storey Drift of Model 1 to Model 10 (M1 to M10)



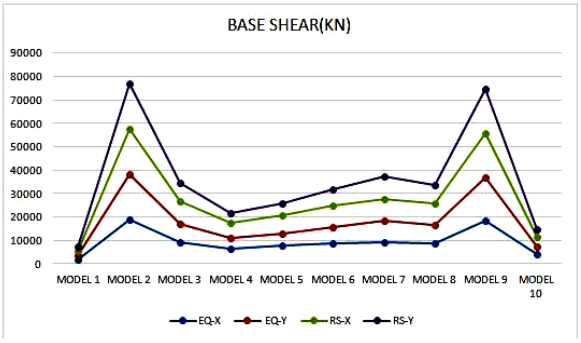
Storey Drift of Model 1 to Model 10 (M1 to M10)



Storey Drift of Model 1 to Model 10 (M1 to M10)

5.3 BASE REACTION

Base shear (kN)				
	Equivalent static method		RSM	
Storey	EQ-X	EQ-Y	RS-X	RS-Y
Model1	1826.9787	1785.8406	1860.7768	1819.8027
Model2	19069.469	19069.469	19423.4637	19437.4366
Model3	9241.4239	7950.8132	9393.4389	8058.7435
Model4	6637.2317	4199.0443	6707.5719	4256.4497
Model5	7813.5316	4966.4695	7939.8077	5028.6397
Model6	8948.1132	6758.9893	9114.7919	6876.5823
Model7	9241.4239	9241.4239	9403.3182	9398.5127
Model8	8948.1132	7852.3832	9077.3197	7931.879
Model9	18482.8478	18482.8478	18832.2357	18838.0257
Model10	4192.9041	3049.4477	4234.5537	3096.1773



Base Shear of Model 1 to Model 10 (M1 to M10) Showing EQ-X, EQ-Y, RS-X & RS-Y

6. SUMMARY

In this study the analysis of G+12 multi-storeyed building located in zone V with ten models provided with soft storey at different floors is studied. The analysis is done by both linear static and linear dynamic method. The results were obtained and compared are displacement, drift, time period and base shear. From this analysis the following conclusion are:-

7. CONCLUSIONS

- Providing the soft storey at the first floor is the most preferable in multi-storeyed building and for the next levels, soft stories at different floor are to be provided as per required measures.
- Results obtained by response spectrum method is more accurate then equivalent static method.
- It can seen that the displacement of M1 (bare frame) is 48.45mm and M5 (full infill with 3rd and 4th floor soft storey) is 11.217mm which shows 23.14% reduction and in M10 (full infill with GF,1st and 2nd floor soft storey) is 15.379mm which shows 31.5% reduction in displacement.
- Time period of the M1 (bare frame) is 2.663 , time period recorded in M3 provided with soft storey at ground floor with infill is 0.632.

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