Seismic Response of Rc Frame Building With Soft Storey At Different Floor Levels

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Abstract- *Many multistorey buildings in India today have open first storey as an unavoidable feature. This is primarily being adopted to accommodate parking or reception lobbies in the first storeys. The upper storeys have brick infilled wall panels. Reinforced concrete (RC) frame buildings with masonry infill walls have been widely constructed for commercial and may effect .so by using to avoid lateral displacement and storey drift, stiffness of masonary infill, performance of soft storey building by using ETABS provided columns and adjacent infills at each corner of building at different floor levels at different zones*

key words: *storey, soft storey, infill walls*

I. INTRODUCTION

A RC framed building with soft storey at different floor levels may give give failure to the particular due to load combination and type of zone related.the given analysis will give safe measures and different calculations that may avoid the failure criteria by using the soft ware ETABS The lateral loads generated by ETABS correspond to the seismic zones II, III, IV & zone V and the 5% damped response spectrum given in IS: 1893-2002.

For the Modeling of the G+10 storey RC building with first soft storey, two soft storey, three soft storey were consider line element was used for beams(230mm x 600mm) and columns(230mm x750mm) and concrete element for slabs in the present investigation, Brick materials are used for masonry infill as internal walls(115mm) and external walls(230mm). The base of structure was fully fixed by constraining all the degrees of freedom

II. OBJECTIVES

The main objective of this dissertation is

1. focus on the behaviour of RC frame buildings with bare frame, bare frame with slab element, first soft storey, second soft storey, third soft storey in seismic zones II, III, IV, and zone V.

2. To study the effect of storey drifts, lateral displacement and base shear in the seismic zones II, III, IV and zone V of bare frame, bare frame with slab element, full infills, and soft storey at different levels of buildings.

3. To check the applicability of the multiplication factor of 2.5 as given in the Indian Standard IS 1893:2002 for design of bare frame, bare frame with slab element, full infills, and soft storey at different levels of building in zones II,III,IV& zone V.

4. To analyze the RC frame for dynamic analysis in relation to the storey drift and lateral displacements, base shear using software ETABS.

5. To study the comparison between the storey drifts, lateral displacements, base shear of all Models in seismic zones II, III, IV and zone V.

6. To investigate the bare frame, soft storey behaviour at different levels of RC frame building for all cases so as to arrive at suitable practical conclusion for achieving earthquake resistant RC frame building.

7. To identify the storey drift where there is exceeds its permissible values of storey drifts i.e.0.004h, in each zone for different Models.

8. To study failure conditions of six Models at different storeys in each zone for all Model buildings.

9. To promote safety without too much changing the constructional practice of reinforced concrete structures

III. METHODOLOGY

The Plan area of building is 32m x 21m, the Models having 4 bays at 8m distance in x-direction and 3 bays at 7m distance in y- direction.

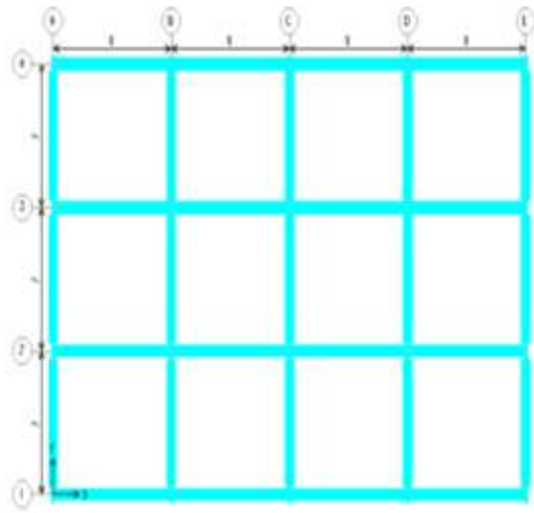

Figure 1 Plan for G+10 storey building

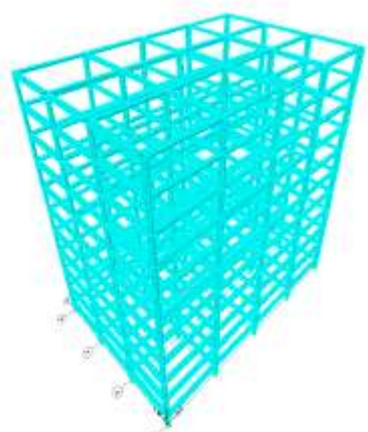

Figure 2 Model 1: G+10 RC bare frame building 3D view

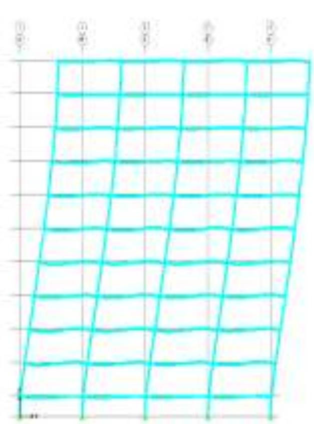

Figure 3 Model 1: G+10 RC bare frame building lateral displacement

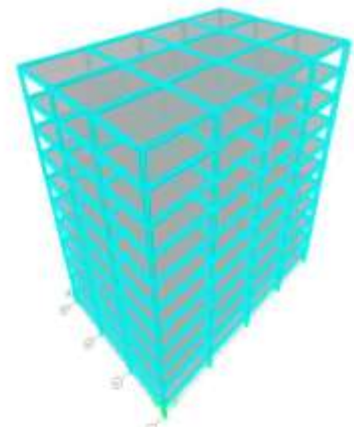

Figure 4 Model 2: G+10 RC bare frame building with slab element 3D view

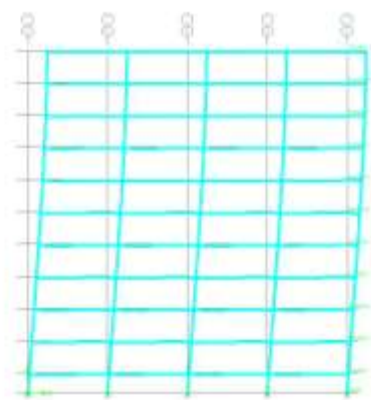

Figure 5 Model 2: G+10 RC bare frame building with slab element lateral displacement

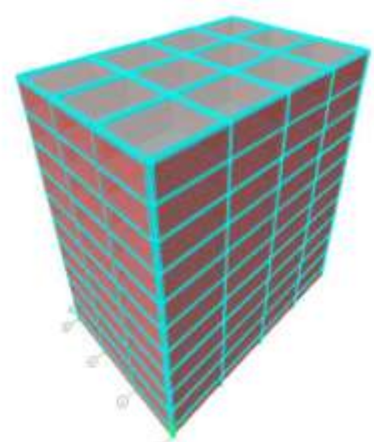

Figure 6 Model 3: G+10 RC building of full infill wall with slab element 3D view

Figure 7 Model 3: G+10 RC building of full infill wall with slab element lateral displacement

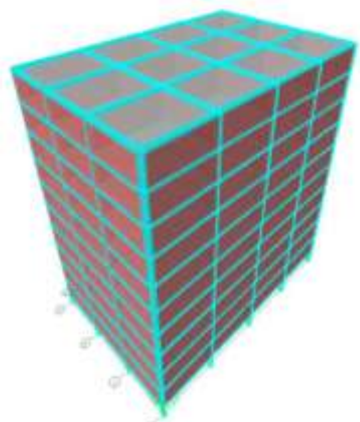

Figure 8 Model 4: G+10 RC first soft storey building with slab element 3D view

Figure 9 Model 4: G+10 RC first soft storey building with slab element lateral displacement

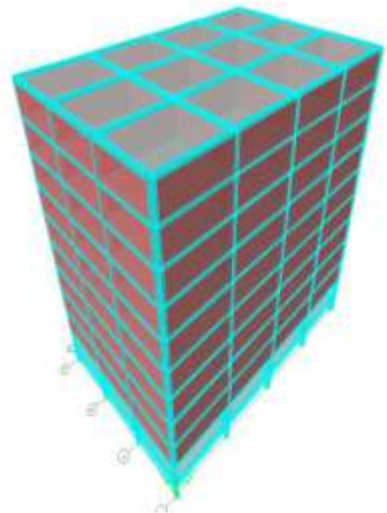

Figure 10 Model 5: G+10 RC two soft storey building with slab element 3D view

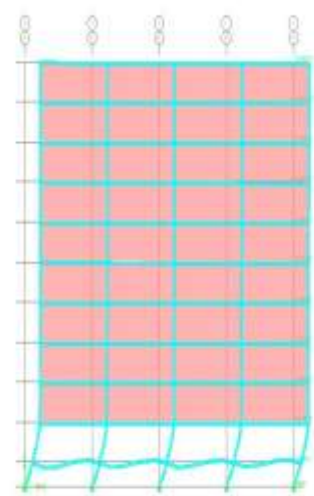

Figure 11 Model 5: G+10 RC two soft storey building with slab element lateral displacement

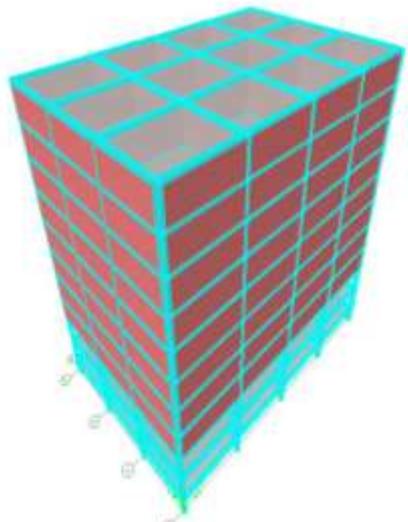

Figure 12 Model 6: G+10 RC three soft storey building with slab element 3D view

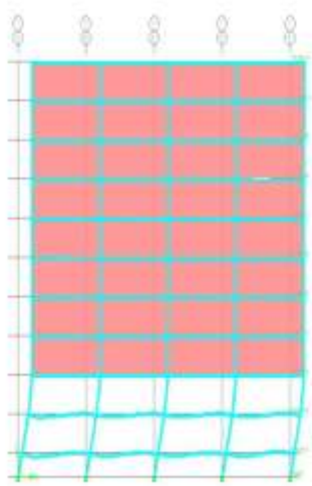

Figure 13 Model 6: G+10 RC three soft storey building with slab element lateral displacement

IV. STRUCTURAL PROPERTIES

Type of frame	Ordinary moment resisting RC frame OMRF) fixed at the base
Seismic zones	II,III,IV,&V
Number of storey	G+10 storey
Floor height	3 m
Depth of Slab	150 mm
Size of beam	(230 × 600) mm
Size of column	(230 × 750) mm
Spacing between frames in x-direction	8 m
Spacing between frames in y-direction	7 m
Materials	M 25 concrete, Fe 415 steel and
Infill	Brick
Thickness of external infill walls	230 mm
Thickness of external infill walls	115 mm
Density of concrete	$24 KN/m^3$
Density of infill	$20\ KN/m^3$
Type of soil	Medium soil
Seismic zone	As per IS (1893-2002)
Seismic zone factor, Z	For zone II: 0.10 For zone III: 0.16 For zone IV: 0.24 For zone V: 0.36
Importance Factor, I	1
Response spectrum analysis	Linear dynamic analysis
Damping of structure	5 percent
Plinth height above ground level	1.8 m
Type of the building	OMRF(Ordinary moment resisting RC frame)
Wall load for the outer side for (3 m height wall)	12.42 KN/m
Wall load for the inner side for (3 m heightwall)	6.21 KN/m
Wall load for the outer side for (1.8 m height wall)	6.90 KN/m
Wall load for the inner side for(1.8 m height wall)	3.45 KN/m
Total Dead load of slab	5.75 KN/m2
Live load	2 KN/m2
For Seismic zone loading only 50% of the imposed load is considered the structure is analyzed for all seismic zone by considering Medium for each seismic zone	

V. RESULTS

The following results were obtained when analyzing the structures in ETABS.

Lateral displacements of Model 1 in zones II, III, IV, and zone V

The graphs shown the variation of lateral displacements of bare frame (model 1) in all seismic zones II, III, IV and zone V respectively.

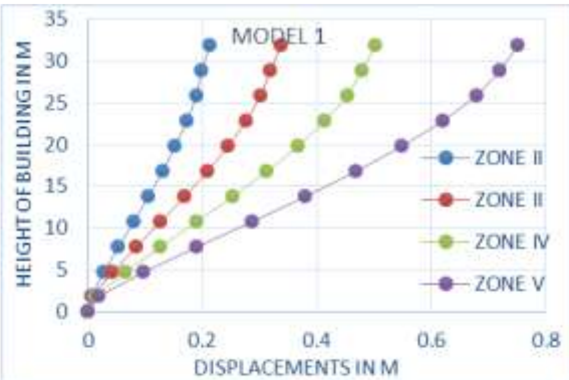

Figure 14 Comparison of lateral displacement in model 1for seismic zones

Lateral displacements of Model 2 in zones II, III, IV, and zone V

The graph shown the variation of lateral displacements for bare frame with slab element (Model 2) in all seismic zones II, III, IV and zone V respectively.

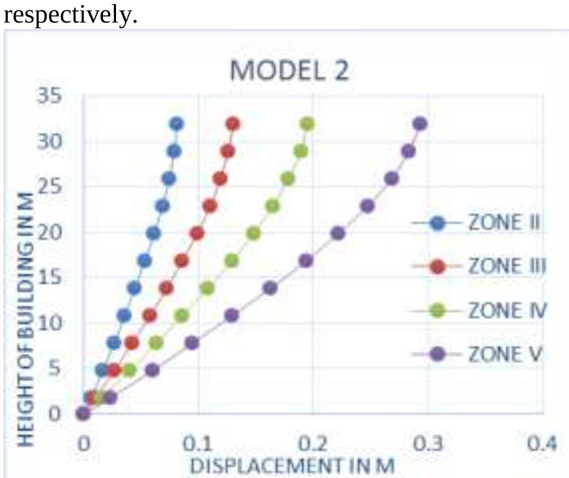

Figure 15 Comparison of lateral displacement in Model 2

Lateral displacements of Model 3 in zone II, III, IV, & zone V

The graph shown the variation of lateral displacements for bare frame with slab element and with full infills (Model 3) in zone II, III, IV, and zone V.

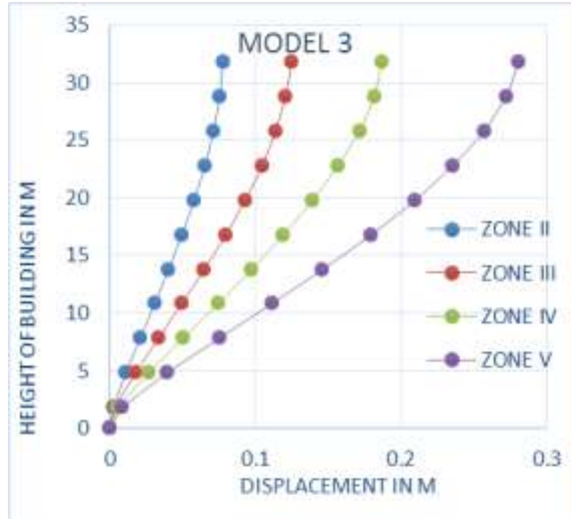

Figure 16 Comparison of lateral displacement in Model 3

Lateral displacements of Model 4 in zone II, III, IV, & zone V.

The graph shown the variation of lateral displacements for bare frame with first soft storey (Model 4) in zone II, zone III, zone IV, and zone V.

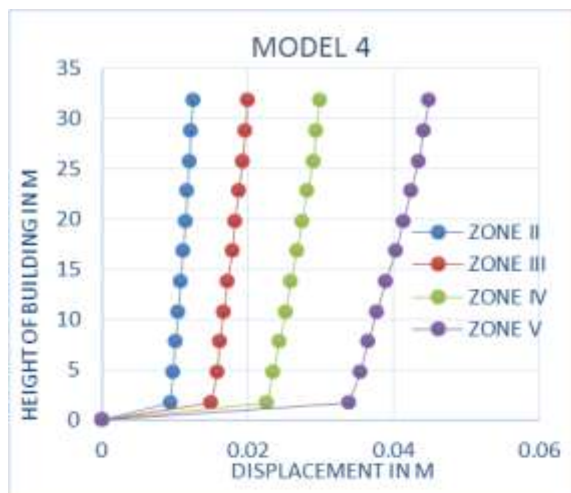

Figure 17 Comparison of lateral displacement in Model 4

Lateral displacements of Model 5 in zone II, III, IV, & zone V

The graph shown the variation of lateral displacements for bare frame with two soft storey building with slab element and with full infills (Model 5) in zone II, III, IV, and zone V.

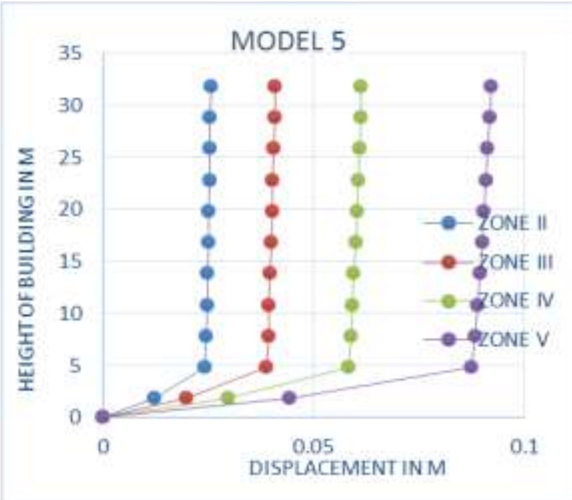

Figure 18 Comparison of lateral displacement in Model 5

Lateral displacements of Model 6 in zone II, III, IV, & zone V

The graph shown the variation of lateral displacements for bare frame with three soft storey building with slab element and with full infills (Model 6) in zone II, III, IV, and zone V.

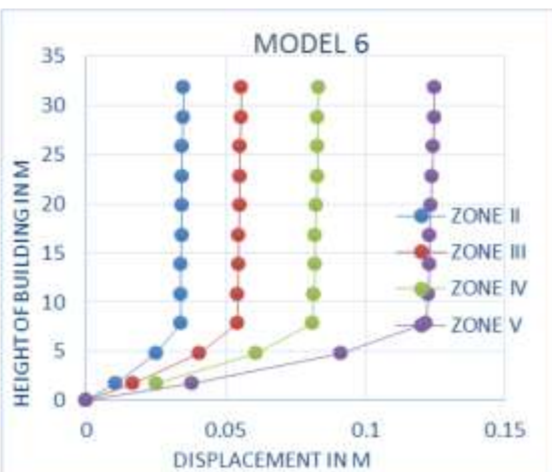

Figure 19 Comparison of lateral displacement in Model 6

VI. CONCLUSION

- The storey drifts observed of the structure are found within the limit as specified by code (IS: 1893-2002, part-1) in linear dynamic analysis.
- Story drift value is more in the story 11 of bare frame as compared to the soft storey at different levels of building.
- The presence of masonry infill influences the overall behaviour of structures when subjected to lateral forces. Lateral displacements and storey drifts are considerably reduced while contribution of the infill brick wall is taken into account.
- Infilled frames should be preferred in seismic zones more than the open first storey frame, because the storey drift of first storey of open first storey frame is very large than the upper storeys, this may probably cause the collapse of structure.
- Lateral displacement of bare frame Model is higher than other Models because of less lateral stiffness of storey, due to absence of infill walls. The lateral displacements were observed in model 2 are reduced to 13.14%, 20.68% 30.74% and 45.82% as compared to the model 1 in zone II, III, IV and zone V respectively
- First storey displacement of soft first storey Model is maximum than other Models due to absence of infill in the first storey. In soft first storey frame, there is sudden change in drifts between first and second storey in all seismic zones.
- Concluded that the providing of infill wall in RC building controlled the displacement, storey drifts and lateral stiffness.
- The increase in base shear in models III, IV and V was 71.64%, 94.54%, 87.34%, 82.93%, and 82.56% respectively when compared to the model 1 in all zones.
- Base shear is more in full infilled Model (model 3) as compared to the other R.C building models.
- Bare frame has a lesser value of base shear as compared to the other R.C building Models.

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