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EFFECTS OF SOFT STOREY ON THE SEISMICRESPONSE OF R.C FRAME BUILDINGS

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ABSTRACT

The concept of open ground storey building (OGS) or Soft Storey has taken its place in the Indian urban environment due to the fact that it provides the parking facility in the ground storey of the building. The cost of construction of this type of building is much less than that of a building with basement parking. During an earthquake, failure of structure starts at points of weakness. This weakness arises due to discontinuity in mass, stiffness and geometry of structure. The structures having this discontinuity are termed as irregular structures. Vertical irregularities are one of the major causes of failures of structures during earthquakes. The effect of vertical irregularities in the seismic performance of structures becomes really important. Soft storey irregularity is one of the main reasons for building damage. Surveys of buildings failed in the past earthquakes show that these type of buildings are found to be one of the most vulnerable. The majority of buildings that failed during the Bhuj earthquake (2001) were of the open ground storey type.

Keywords- *Soft storey, SEISMICRESPONS, R.C frame buildings.*

I. INTRODUCTION

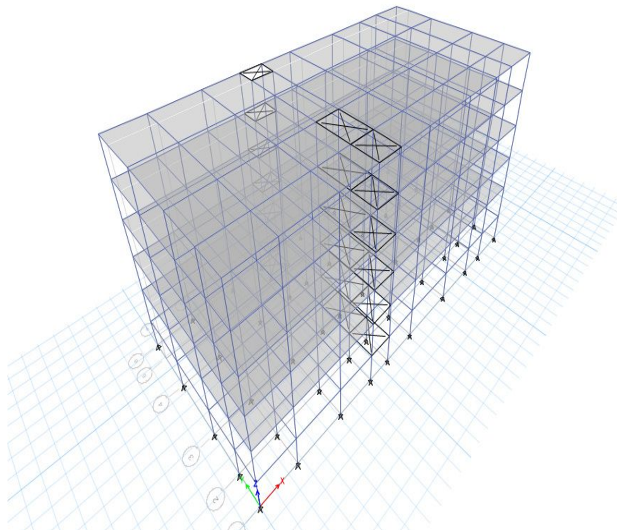
Nowadays, soft storey (also known as open ground storey) buildings are commonly used in the urban environment since they provide parking area, which is most required. In RC frame buildings, brick walls are just architectural point of view and to make partition and other aspect. In general, the multi-storey buildings subjected to vertical loads i.e. dead or live, do not cause much effect, but the lateral loads (wind or earthquake) are a matter of great concern and need special consideration in the design of buildings. These types of buildings show comparatively a higher tendency to collapse during earthquake because of the soft storey effect. Large lateral displacements get induced at the first floor level of such buildings yielding large curvatures in the ground storey columns. There is significant advantage of these category of buildings functionally but from a seismic performance point of view such buildings are considered to have increased vulnerability. From the past earthquakes it was evident that the major type of failure that occurred in open ground storey (OGS) buildings included snapping of lateral ties, crushing of core concrete, buckling of longitudinal reinforcement bars etc.

II. METHOD & MATERIAL

In this study, 4 different models have been considered,

- Bare frame,
- Complete infill,
- Soft storey at ground level,
- Shear walls at lift and staircase in ground storey.

The structure is a G+5 residential building. For the plan given below, the building is analyzed for gravity, wind and earthquake (Non-linear dynamic analysis) and various internal forces. Reactions, bending moment, shear force, axial force of the members (columns) at various levels, joint displacements, base shears, lateral forces in all the cases has to be studied and compared. The analysis is carried out on structural software **ETABS** with the parameters given below.



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3D Computer model of building without and with considering infill stiffness respectively.

III. RESULT & DISCUSSION

Base Shear

It is the total design lateral force at the base of a structure. Hence after analyzing the Building the results obtained for three models in both longitudinal and transverse direction and there comparisons are presented in tabular form,

	Bare frame	Soft Ground Storey	Complete Infill	Soft Storey with Shear Walls
	(kN)	(kN)	(kN)	(kN)
X- Dir	3460.75	6596.36	6820.93	6819.46
Y- Dir	2798.87	4695.88	5865.30	5237.91

TABLE 7.5: Comparisons of Base Shear for different models.

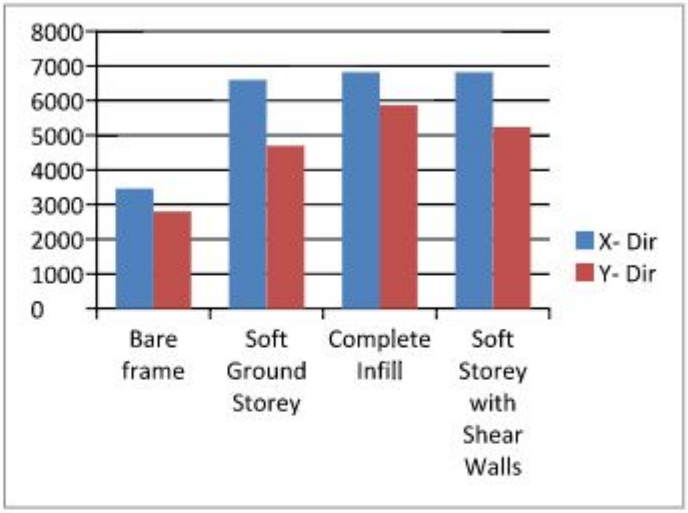

Fig. 7.5 Base Shear in (kN) for various models

IV. CONCLUSION

The following Conclusions are drawn based on the study conducted

- The presence of shear wall at lift and staircase can affect the seismic behavior of frame structure in decreasing the displacements of the building.
- Storey drift values of the infill wall at bottom storey are found to be well within the prescribed limits of Indian Standard code of practice.
- It is found that the shear wall in the open ground storey significantly contributes to the structural stiffness and reduces the maximum inter storey drift of the building.

The presence of soft storey leads to underestimation of load carrying capacity of structure with soft storey than the structure without soft storey.

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