

# Seismic Effect of Regular and Irregular RC Building with and Without Infill Frames using ETABS

M. Praveen Kumar Goud, V. Naresh Kumar Verma

**Abstract:** This work is on the seismic behaviour of regular and irregular RC buildings with and without infill frames. It's below stood that buildings that are regular in plan (regular building) perform far better than those which have irregularity in plan (irregular building) under seismic loading. Irregularities don't seem to be avoidable in construction of buildings. This method of analysis is projected in terms of equivalent statics, response spectrum and pushover analysis consistent with IS 1893:2002(part 1) code. Results of those analyses are mentioned in terms of the bottom construction drift and storey stiffness. From these results it's finished that laterel displacement and construction drift are going to be a lot of in vacant frame compare with the infill frames, whereas the bottom shear are going to be less in normal frame compare with the infill frames. It is also observed that lateral displacement and story drifts are more in irregular buildings than regular buildings.

**Keywords:** storey drifts and storey stiffness

## I. INTRODUCTION

It is necessity for structural engineer to make sure that the building will stand up to odd behaviours of surroundings like wind, seismic forces etc. each steps ought to be taken so as to avoid destruction due to lateral forces. Major reason behind destruction is thanks to earthquakes wherever several lives are at risk and most of individuals become homeless due to folded or unsafe buildings. A structure must design so as to resist lateral force that cause earthquake. To implement this structure ought to be in-built lateral load resisting system. This system is achieved by victimization moment resisting frames, shear walls and infill frames. The moment resting frame resists the laterel actions by framing action of rigid connections at joints. Infill frames and shear walls maybe masonry however are generally made in concrete and resist laterel actions through in-plane resistance of shear wall. To avoid damage throughout earthquake the structure ought to be straightforward and regular in set up, a lot of laterel strength, stiffness and malleability. Buildings with regular in set up will suffer less injury than buildings with irregular in plan.

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\* Correspondence Author

**M.Praveen Kumar Goud**, Structural student, Department of Civil Engineering, Gokuraju Rangaraju institute of Engineering and Technology, Hyderabad, India, email id:praveen.malela@gmail.com

**V.Naresh Kumar Verma**, Assistant Professor, Department of Civil Engineering, Gokuraju Rangaraju institute of Engineering and Technology, Hyderabad, India

## II. IRREGULARITY OF STRUCTURE

The irregularities within the building structures have irregular distribution in mass, strength and stiffness throughout the peck of building. Once such buildings are created in high unstable zones, the analysis and style becomes a lot of sophisticated. There are two sorts of irregularities:

1. Plan irregularity
2. Vertical irregularity

Plan irregularity usually refers to the uneven distribution of stiffness or strength within plan of structure leading to a tortional response of the structure underneath unstable forces. Structures with plan irregularities suffer a lot of harm in earthquake as a result of response isn't solely travel however conjointly it's torsional.

Vertical irregularity refers to uneven distribution of mass on peak of a multi-storey building ever-changing the ground arranges between the adjacent floors. Throughout a unstable force the result may be soft structure mechanism.

## III. OBJECTIVES OF STUDY

1. To calculate the look laterel forces for each regular and irregular buildings with and while not infill frames by victimisation response chemical analysis and compare the results for various structures.
2. To review three completely different irregularities in structures particularly mass, stiffness and vertical geometrical irregularities.
3. To review the behaviour level of structure.

## IV. METHODOLOGY

Based on the type of externally applied load and behavior of structure the seismic methods of analysis considered for the study are Linear Static Analysis, Linear Dynamic Analysis and Non-Linear Static Analysis.

- **Linear Static Analysis:** Linear static analysis can be performed by equivalent static lateral force method.
- **Linear Dynamic Analysis:** Linear dynamic analysis can be performed in two ways either by Mode Superposition Method (Response Spectrum Method) or Elastic Time History Method.
- **Non-linear Static Analysis:** This is an improvement over the linear static or dynamic analysis in the sense that it allows the inelastic behavior of the structure.

**V. MODELLING**

Dimensions and centre drawing is should for the execution of the building and analysis of the building in ETABS this values are taken type trial and error primarily based theory. Grades of concrete, steel and IS-codes are taken this are shown brlow:

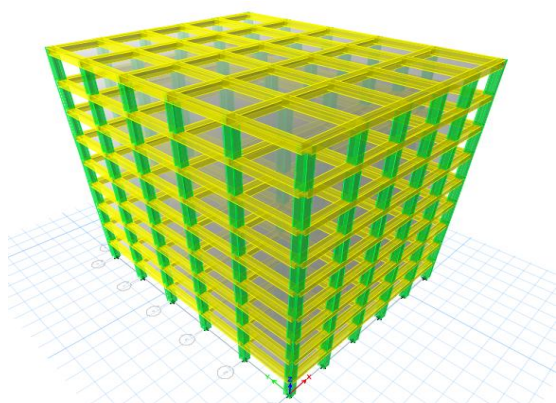
- Slab thickness : 150mm
- Beam dimensions : 230x600mm
- Column dimensions : 600x600mm
- Shear wall thickness : 250mm
- Building height : 30m
- No. of stories : G+9
- Steel : fe500
- Concrete : M30
- IS Codes : IS 1893:2002(part1)  
IS 875:1987(part3)
- Software used : ETABS 2016

**VI. ULTIMATE LOAD COMBINATIONS**

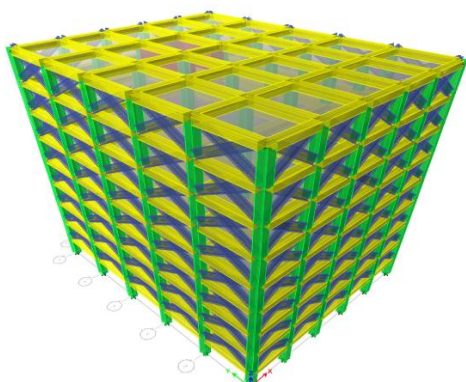
- 1.5(dead load +impose load )
- 1.2(dead load +impose load ± earthquake load )
- 1.5(dead load ±earthquake load )
- 0.9 load ±1.5 earthquake load

**VII. SERVICES LOAD COMBINATIONS**

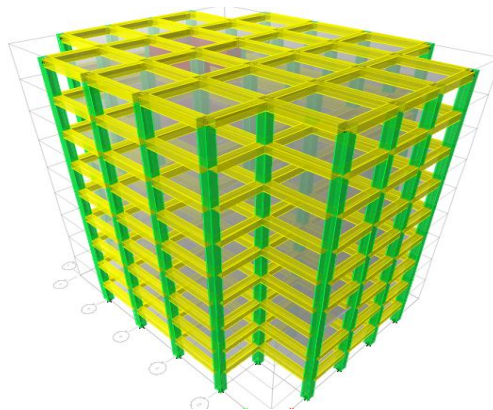
- load + impose load
- load ± earthquake load
- load +0.8 impose load ±0.8 earthquake load



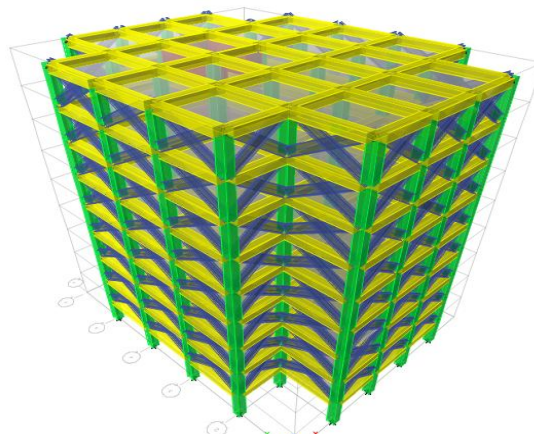
**Model(a)**



**Model(b)**



**Model(c)**



**Model(d)**

Model(a): regular structure without infill frames  
 Model(b): regular structure with infill frames  
 Model(c): irregular structure without infill frames  
 Model(d): irregular structure with infill frames

**VIII. RESULTS AND DISCUSSIONS**

We have different results for seismic in ETABS but some of them are taken into consider. They are:

- story drifts and
- story stiffness

**Storey drifts:**

**Table 1-storey drift along x-direction for model(a) and model(b) respectively**

Storey	Elevati on (m)	Location	Model (a)	Model (b)
			x-direction (mm)	x-direction (mm)
Storey 9	27	top	0.000011	0.000005
Storey 8	24	top	0.000013	0.000005
Storey 2	6	top	0.000007	0.000005
Storey 1	3	top	0.000088	0.000043
base	0	top	0	0

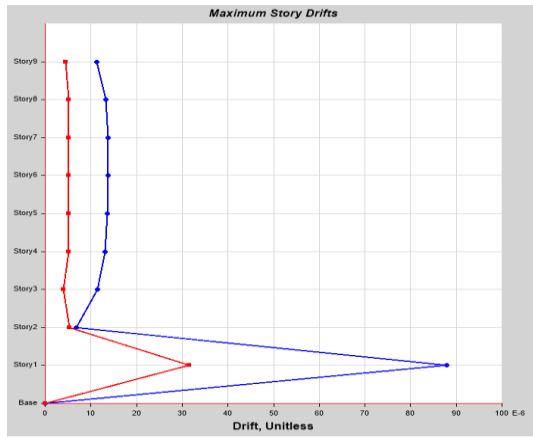


Fig 1

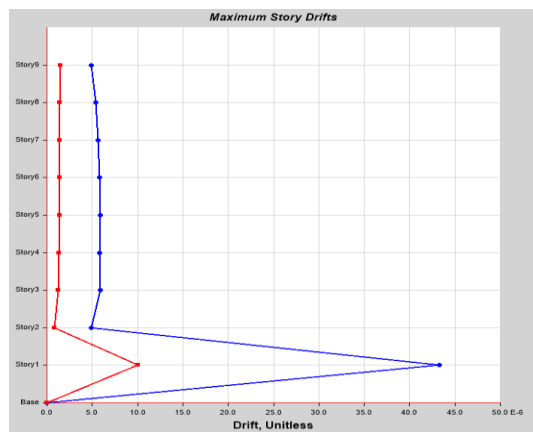


Fig 2

fig 1 and fig 2 are storey drifts along x-direction for model(a) and model(b) respectively

Table 2-storey drifts along x-direction for model(c) and model(d) respectively

Storey	Elevation (m)	Location	Model (c)	Model (d)
			x-direction (mm)	x-direction (mm)
Storey 9	27	top	0.000011	0.000005
Storey 9	24	top	0.000013	0.000006
Storey 9	6	top	0.000006	0.000005
Storey 9	3	top	0.000088	0.000045
base	0	top	0	0

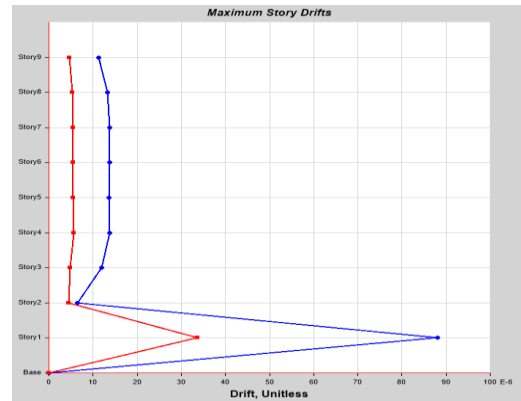


Fig 3

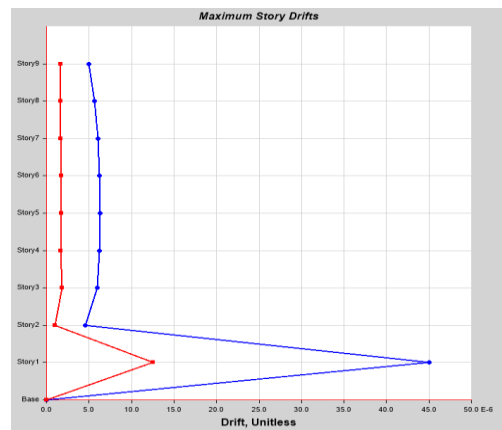


Fig 4

fig3 and fig4 are storey drifts along x-direction for model(c) and model(d) respectively

from table1 and table2 we can see that storey drifts less in structure with infill frames than structure without infilled frames so the different type of structures with infill frames will be more suitable for seismic conditions.

Storey stiffness:

Table 3-storey stiffness along x-direction for model(a) and model(b) respectively

Storey	Elevation (m)	Location	Model (a)	Model (b)
			x-direction (mm)	x-direction (mm)
Storey 9	27	top	2897114.206	12735781.068
Storey 8	24	top	2387291.389	11101801.601
Storey 2	6	top	4195442.904	16663313.339
Storey 1	3	top	2956444.528	4042886.11
base	0	top	0	0

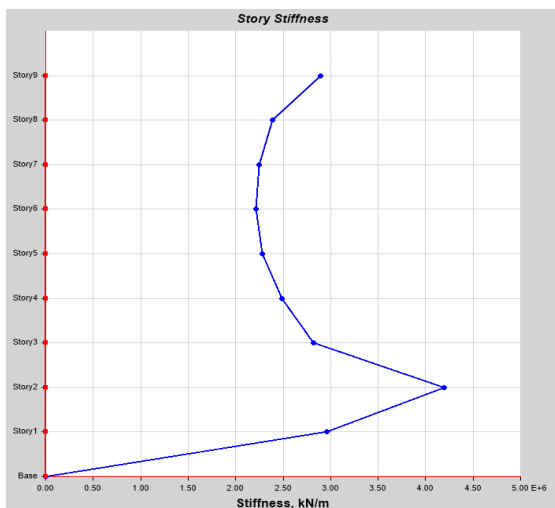


Fig 5

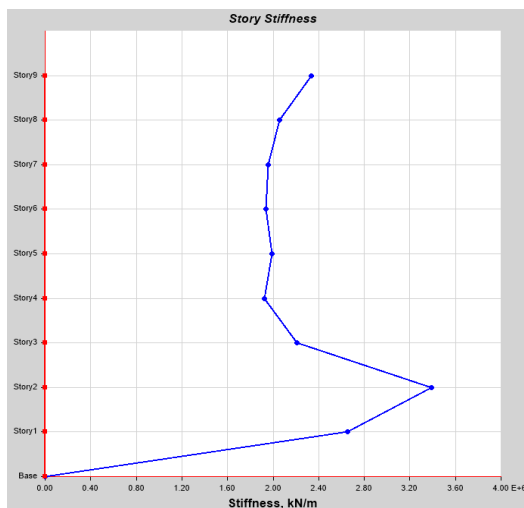


Fig 7

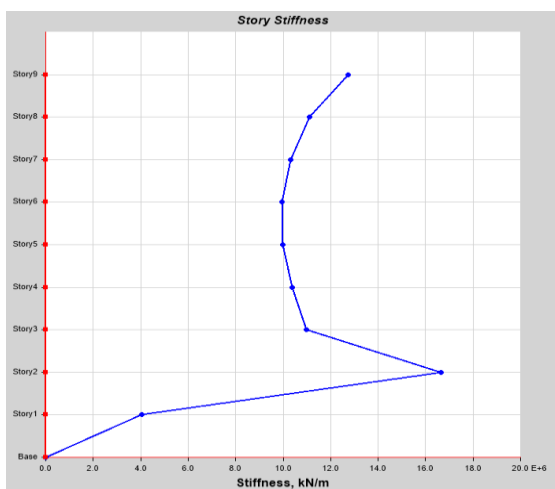


Fig 6

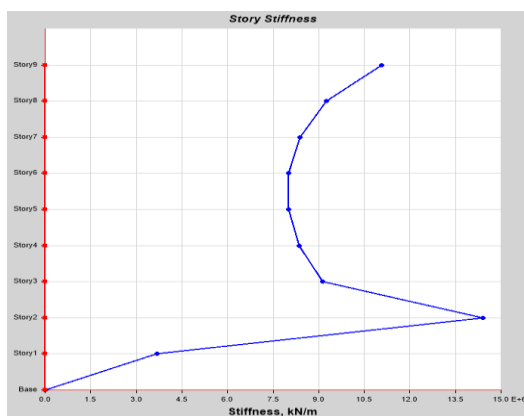


Fig 8

and fig6 are storey stiffness along x-direction for model(a) and model(b) respectively

fig7 and fig8 are storey stiffness along x-direction for model(c) and model(d) respectively

Table 4-storey stiffness along x-direction for model(c) and model(d) respectively

Storey	Elevation (m)	Location	Model (c) x-direction (mm)	Model (d) x-direction (mm)
Storey 9	27	top	2337532.633	11062991.202
Storey 8	24	top	2055632.238	9264664.435
Storey 2	6	top	3388230.567	14401195.662
Storey 1	1	top	2651316.327	3682145.254
base	0	top	0	0

from table3 and table4 we can see that storey stiffness less in structure with infilled frames than structure without infilled frames so the different type of structures with infilled frames will be more suitable for seismic conditions.

IX. CONCLUSION

- It's essential to ponder the impact of masonry for the seismic forces of moment resting RC frames significantly for the prediction of its final state. If infill can increase the lateral resistance and level stiffness of the frames appear to possess a significant impact on the reduction of the laterel displacement.
- Infill having no irregularity having helpful effect on buildings. In infill frames with irregularities, like blank frames, injury was found to concentrate inside the amount where the separation happens.
- Because of infill action proportion can increase in base shear as a result of the irregularity will increase that shows the irregular the irregular building has got to be designed for high base shear than normal building.
- The obtained level drifts from analysis with quantitative relation of one are at intervals the permissible limits for every regular and irregular frames.





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## AUTHORS PROFILE



**M.Praveen Kumar Goud**, presently pursuing masters in structural Engineering at Gokaraju Rangaraju Institute of Engineering and Technology, Hyderabad.



**V.Naresh Kumar Verma** is working as a assistant professor in the Department of Civil Engineering, Gokaraju Rangaraju Institute of Engineering and Technology, Hyderabad, Telangana, India.