

Effect of Mass Irregularity on Reinforced Concrete Structure Using Etabs

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ABSTRACT: Irregularities are not avoidable in construction of buildings; however the behavior of structures with these irregularities during earthquake needs to be studied. Adequate precautions can be taken. A detailed study of structural behavior of the buildings with irregularities is essential for design and behavior. Civil engineering structures are mainly designed to resist static load. Generally the effect of dynamic loads acting on structure is not considered. This feature of neglecting the dynamic forces sometimes becomes the cause of disaster, Over the last two decades, wind engineering has increasingly focused on the modest low rise and high rise structures, since much of the damage and financial loss associated with extreme wind events happens to these minimally engineered buildings like low rise buildings and also huge loss if encountered by the high rise buildings. As some of these model- and full – scale wind engineering data filters into the design codes and standards, one may expect to see reduced hurricane/cyclone damage. However, when one combines the more rapid increase in population along the world’s tropical coasts with a generally unacceptably low standard of new building construction inspection, it seems quite likely that loss of life, as well as insured and uninsured property losses will continue to be the norm in the foreseeable future. The wind engineering community needs to be more responsible in forcefully transferring our technical knowledge to the designer and builder. In this present work analysis for G+10 Reinforced cement concrete building having mass irregularity in 3rd and 6th floors and building without mass irregularity are analysed. This paper highlights the effects on floor which has different loads (mass irregularity) in multistorey building

KEYWORDS: Mass irregularity, Wind analysis, Storey displacement, storey drift.

I. INTRODUCTION

The 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 reasons of failures of structures. Height-wise changes in stiffness and mass render the dynamic characteristics of these buildings different from the ‘regular’ building. The irregularity in the building structures may be due to irregular distributions in their mass, strength and stiffness along the height of building.

There are two types of irregularities-

1. Plan Irregularities
2. Vertical Irregularities.

Vertical Irregularities are mainly of five types:

1) Stiffness Irregularity -

a) Soft Story- A soft story is one in which the lateral stiffness is less than 70 percent of the story above or less than 80 percent of the average lateral stiffness of the three story’s above.

b) Extreme Soft Story- An extreme soft story is one in which the lateral stiffness is less than 60 percent of that in the story above or less than 70 percent of the average stiffness of the three story’s above.

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- 2) Mass Irregularity- Mass irregularity shall be considered to exist where the weight of any story is more than 200 percent of that of its adjacent story's. In Case of roofs irregularity need not be considered.
- 3) Vertical Geometric Irregularity- A structure is considered to be Vertical geometric irregular when the horizontal dimension of the lateral force resisting system in any story is more than 150 percent of that in its adjacent story.
- 4) In-Plane Discontinuity in Vertical Elements Resisting Lateral Force-An in-plane offset of the lateral force resisting elements greater than the length of those elements.
- 5) Discontinuity in Capacity — Weak Story-A weak story is one in which the story lateral strength is less than 80 percent of that in the story above.

II. OBJECTIVES OF THE WORK

The objectives of the thesis that has been carried out are as follows:

1. To carryout analysis of the considered mass irregularity building and building without mass irregularity using ETABS.
2. To carryout design of the considered mass irregular building and building without mass irregularity.
3. To analyze the building as per code IS 875 Part III criteria for wind loads.
4. To check the analysis results of ETABS for lateral stability checks as per IS code provisions for wind loads.
5. Refuse area is placed at 3rd and 6th story and their Shear force, Bending Moment, Displacement & story drift are noticed.

III. STRUCTURAL SPECIFICATIONS

Type Of Building	Building With Mass Irregularity	Building Without Mass Irregularity
No. of Stories	G+10	G+10
Story height	3m	3m
Type of building use	Residential	Residential
Material Properties		
Grade of concrete		
a)Beams	M25	M25
b)Column	M25	M25
Density of reinforced concrete	25KN/m ³	25KN/m ³
Density of brick masonry	20KN/m ³	20KN/m ³
Member Properties		
Thickness of slab	0.15m	0.15m
Beam size	0.23mx0.45m	0.23mx0.45m
Column size	0.3mx0.90m	0.3mx0.8m
Thickness of wall	0.23m	0.23m
Dead load Intensities		
Floor finishes	1.0KN/m ²	1.0KN/m ²
Live load intensities		
Roof	1KN/m ²	2KN/m ²
Floor(rooms and corridors)	2KN/m ² & 3 KN/m ²	2KN/m ² & 3KN/m ²
Refuse area	13KN/m ²	3m ²

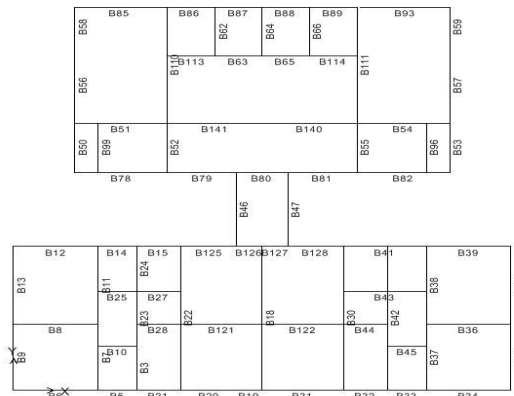


Fig 1: Beam labels

IV. RESULTS AND DISCUSSIONS

4.1 Shear force of 89th beam in each storey for building with mass irregularity and building without mass irregularity is shown in figure below

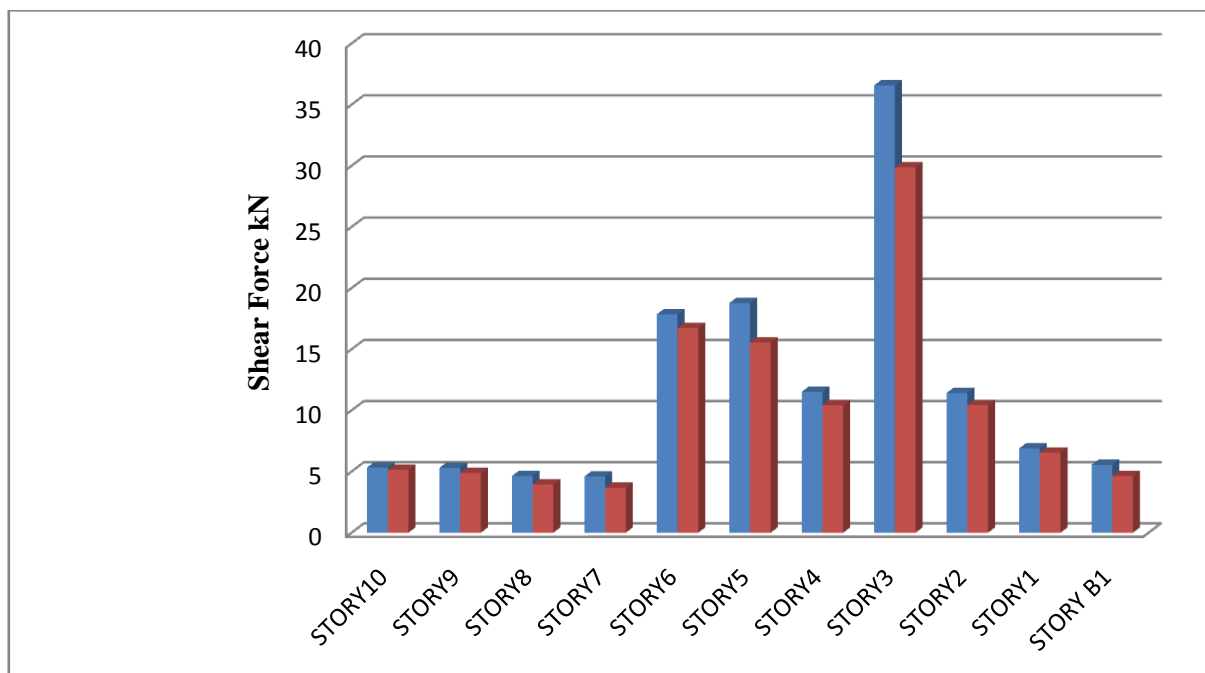


Fig 1: Comparison of shear force

4.2 Bending moment of 89th beam in each story for building with mass irregularity and building without mass irregularity is shown in figure below

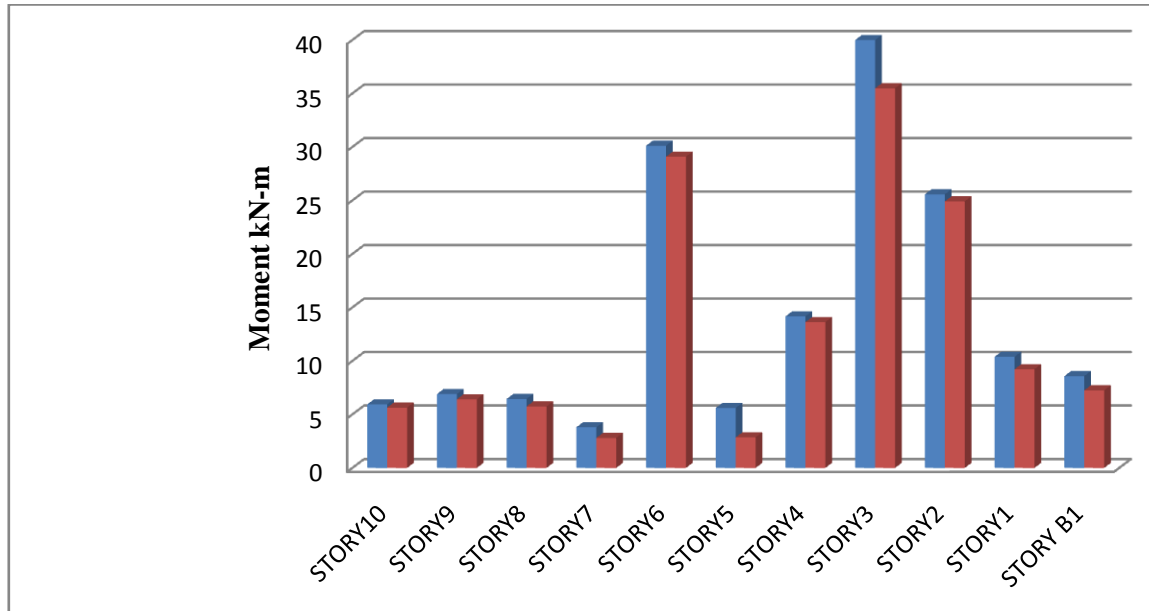


Fig 2: Comparison of moment

4.3 Displacement at 53rd point in building with mass irregularity and building without mass irregularity in X direction is shown in figure below

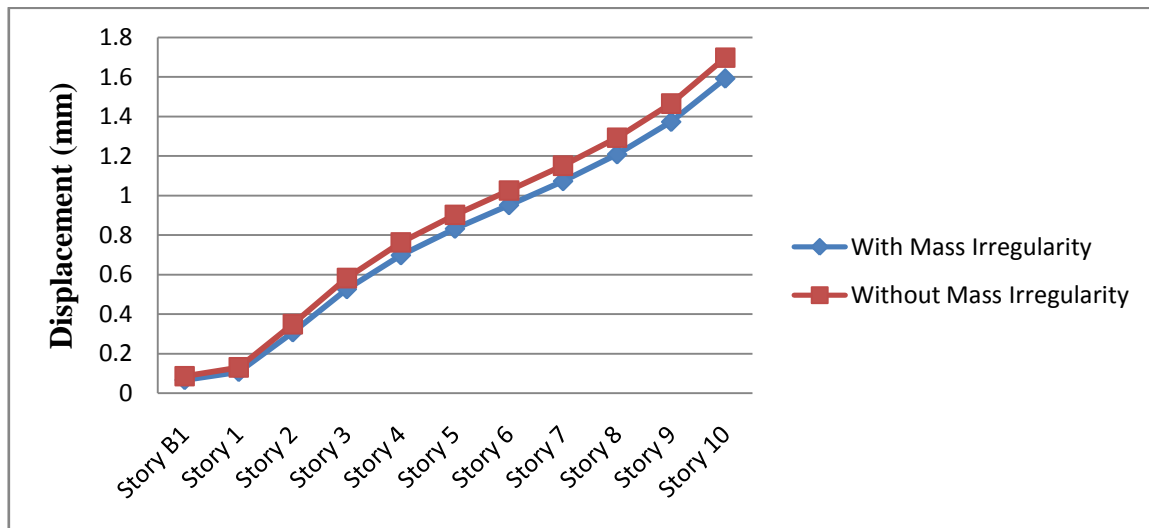


Fig 3: Comparison of Displacement in X direction

4.4 Displacement at 53rd point in building with mass irregularity and building without mass irregularity in Y direction is shown in figure below

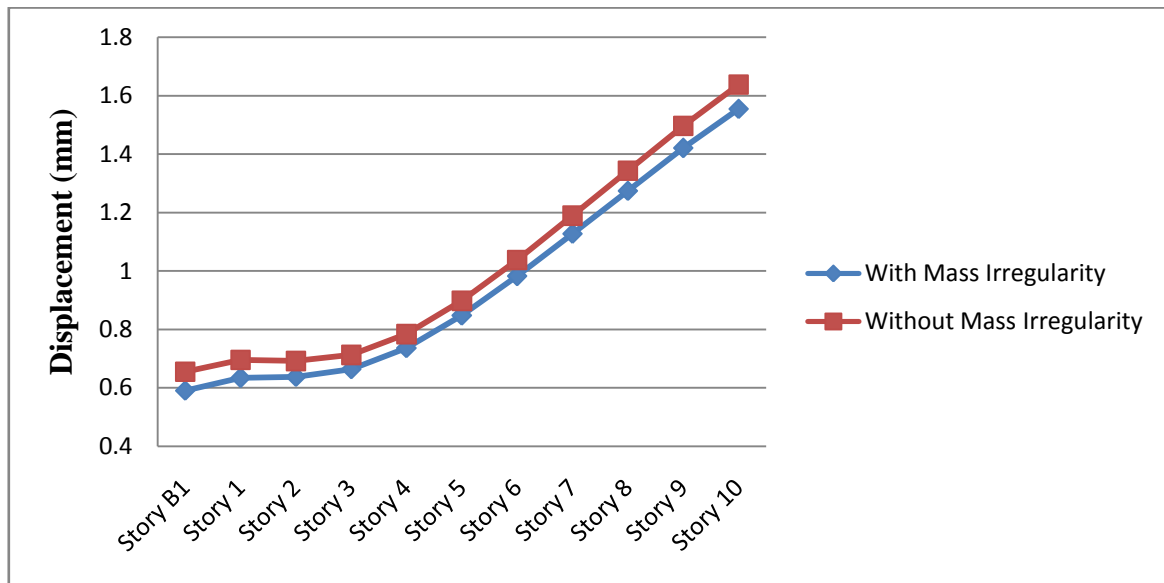


Fig 4: Comparison of Displacement in Y direction

4.5 Drift for building with mass irregularity and building without mass irregularity in X direction is shown in figure below

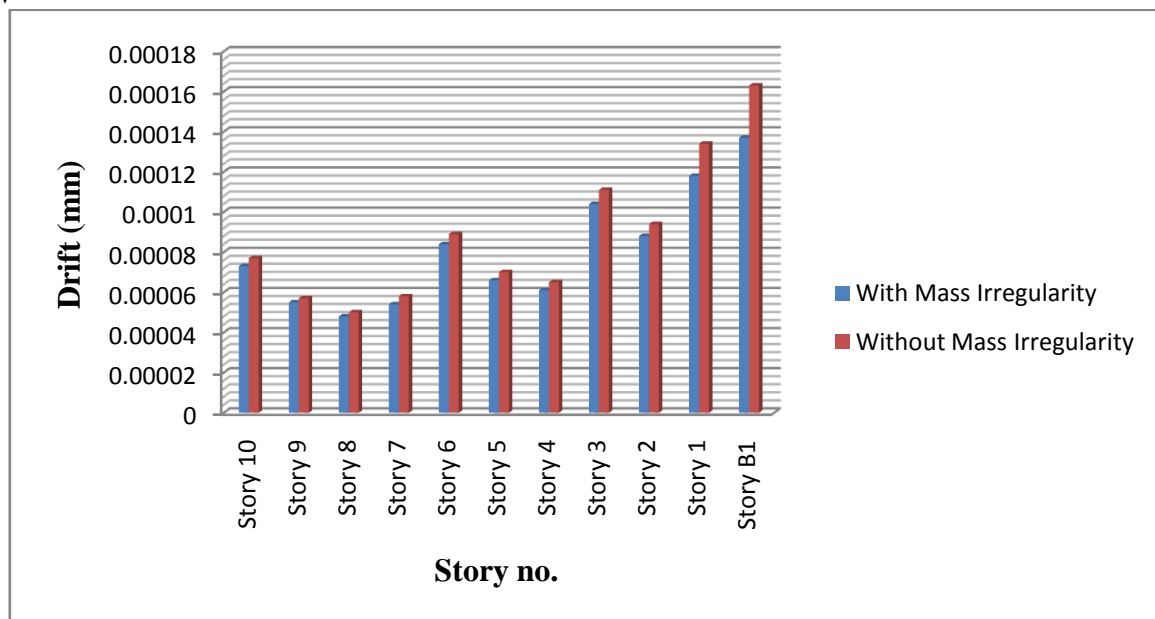


Fig 5 Comparison of Drift in X direction

4.6 Drift for building with mass irregularity and building without mass irregularity in Y direction is shown in figure below

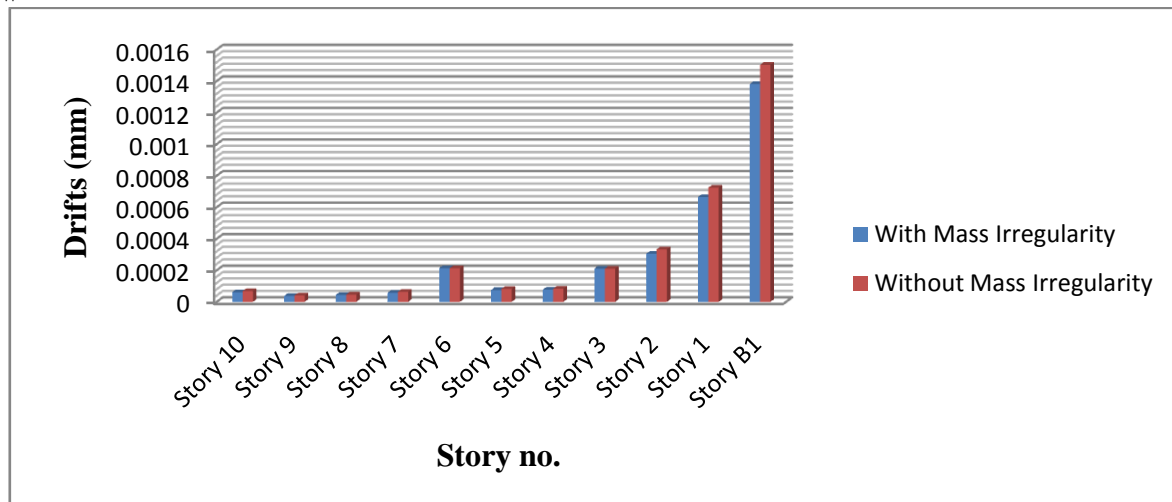


Fig 6: Comparison of Drift in Y direction

V. CONCLUSIONS

1. From the results, it was observed that Beams in refuse area are expected to have more shear force and bending moment.
2. From the results, it was observed that Deflection is more in case of refuse area beams of mass irregular building when compared to building without mass irregularity.
3. From the results, it was observed that there is an increase of 67% in the moments of mass irregular buildings than buildings without mass irregularity.
4. Size of the structural members also increases for buildings with mass irregularity.
5. Since the load acting in mass irregular building is more the displacements in buildings with mass irregularity are less than buildings without mass irregularity.
6. From the results, it was observed that Drifts in building without mass irregularity are more than buildings with mass irregularity.
7. From the results, it was observed that there is increase in steel for the building with mass irregularity.

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