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Seismic Analysis of Multistory Building Having Plan Irregularities with and without Shear Wall

Rishikesh Kanungo[1], Sourabh Dashore[2]
[1]Mtech scholar, Department of Civil Engineering, Sanghavi Institute of Management and Science, Indore
[2]Assistant professor, Department of Civil Engineering, Sanghavi Institute of Management and Science, Indore

***Abstract*- Extinct earthquakes events demonstrate that, a building with irregularity is vulnerable to earthquake damages. So as it's essential to spot the seismic response of the structure even in high seismic zones to cut back the seismic damages in buildings. The most important objective of this study is to grasp the behavior of the structure in high seismic zone III and also to evaluate Storey overturning moment, Storey Drift, Lateral Displacement, Design lateral forces. In the present study, Comparative Dynamic Analysis for all four cases have been investigated to evaluate the deformation of the structure. The results indicate that, building with severe irregularity produces more deformation than those with less irregularity particularly in high seismic zones. And conjointly the storey overturning moment varies inversely with height of the storey. The storey base shear for regular building is highest compare to irregular shape buildings.**

Index terms- Rectangular Building, H- Shape of Building, L-Shape of Building, Shear wall, Static Force and Seismic Force, Bending Moment, Lateral Displacement, Story Drift.

1. INTRODUCTION

A high-rise building is a tall building, as opposed to a low-rise building and is defined by its height differently in various jurisdictions. It is used as a residential, office building, or other functions including hotel, retail, or with multiple purposes combined. Residential high-rise buildings are also known as tower blocks and may be referred to as "MDUs", standing for "multi-dwelling unit". A very tall high-rise building is referred to as a skyscraper. A building, or edifice, is a structure with a roof and walls standing more or less permanently in one place, such as a house or factory. Buildings come in a variety of sizes, shapes, and functions, and have been adapted throughout history for a wide number of factors, from building materials available, to weather conditions, land prices, ground conditions, specific uses, and aesthetic reasons. To better understand the term building compares the list of no building structures.

1.1DIFFERENT SHAPES AND IRREGULARITIES

Nowadays, most buildings are delineated by irregular in both plan and vertical configurations. Irregularities in arrange and lack of symmetry might imply vital eccentricity between the building mass and stiffness centers, give rise to damaging coupled lateral response

The irregularity of the structure might will classify in 2 sorts i.e. Plan and vertical, these are often characterized by 5 differing types like torsional, re-entrant corners, diaphragms separation, out of arrange offset and non-parallel system for plan irregularity likewise as vertical irregularity like stiffness (soft storey), mass, vertical geometric, in plane separation in vertical components resisting lateral force and separation in capability (weak storey) (IS 1893(Part I): 2002)

1.2 TYPES OF IRREGULARITIES

The irregularities are of following 2 types:-

1. Plan Irregularities
2. Vertical Irregularities.

2. STRUCTURAL ANALYSIS AND DESIGN SOFTWARE

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2.1 DESIGN PHILOSOPHIES

- Under minor but frequent shaking, the main members of the buildings that carry vertical and horizontal forces should not be damaged; however buildings parts that do not carry load may sustain repairable damage.
- Under moderate but occasional shaking, the main members may sustain repairable damage, while the other parts that do not carry load may sustain repairable damage.

2.2 SHEAR WALL

In structural engineering, a shear wall is a vertical element of a seismic force resisting system that is designed to resist in-plane lateral forces, typically wind and seismic loads. In many jurisdictions, the International Building Code and International Residential Code govern the design of shear walls.

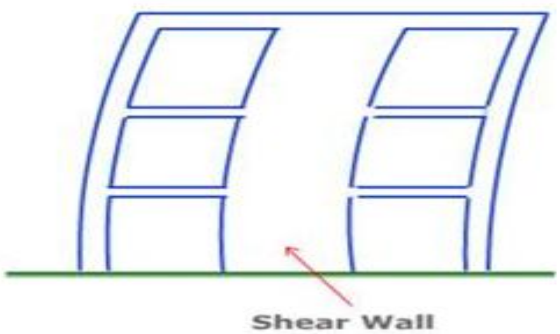

Fig. 2.1 SHEAR WALL

3. PROBLEM FORMULATION

The object of the present work is to compare the behavior of high Rise buildings with vertical irregularities having shear wall with and without shear walls under seismic forces. Also, different shape of building. For this purpose a high Rise building of 10 storey's is considered. To reduce lateral displacement and storey drift shear walls have been provided. The structure is 32m in x-direction & 24m in y-direction with columns spaced at 4m from center to center.

The storey height is kept as 3.0m.Basically model consists of multiple bay 10 storey building, each bay having width of 4m. The storey height between two floors is 3.0m with beam and column sizes of 0.45x0.45m respectively and also the slab thickness is taken as 0.125m. Shape of the building for all the

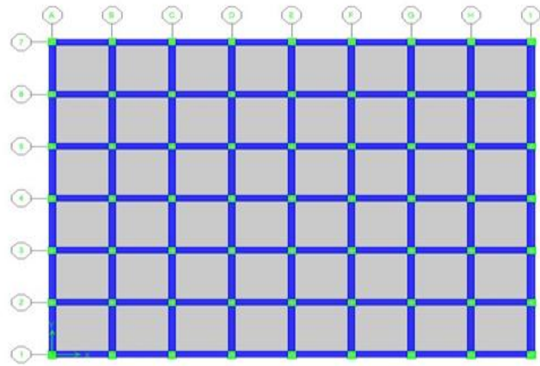

Figure 4.1 Different shapes of building for all cases

3.2 LOADINGS CONSIDERED

- Dead Load- floor load,Wall load, Parapet Load as per to IS 875 (part1).
- Live Load- 2 kN/m2 on all the floors.
- Earthquake Load- As perIS 1893 (part-I):2002.

3.3. LOAD COMBINATIONS

Load combinations considered are as follows:

- 1.2(DL +LL - EQX)
- 1.2(DL +LL + EQZ)
- 1.2(DL +LL - EQZ)
- 1.5(DL + LL)
- 1.5(DL + EQX)
- 1.5(DL - EQX)
- 1.5(DL + EQZ)
- 1.5(DL - EQZ)
- 1.2(DL +LL + EQX)

3.4STAAD.PRO MODEL DETAILS OF RECTANGULAR BUILDING WITHOUT SHEAR WALL.

The performance of shear walls is assessed for High rise building with shear wall and without SW building having 10 storeys for different shape of building in common earthquake zones III. The results obtained from analysis are given in various tables and figures are as follows:

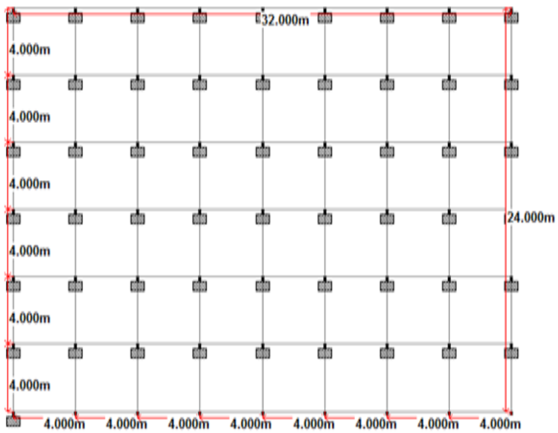

Figure 3.2 Dimension plan of rectangular building without shear wall

4. RESULTS AND DISCUSSIONS

4.1 MAXIMUM BM, MAXIMUM SF IN BEAM AND COLUMN

Table 4.1 Load of combination 1.5(DL+LL)Zone III

Max B.M. And Shear Force of Beam				
Force	Rectangular without SW	Rectangular with SW	H-shape building with SW	L-shape building with SW
B.M. My	0.234 kN-m	0.025kN-m	0.008kN-m	0.368 kN-m
B.M. Mz	60 kN-m	60.531kN-m	56.303kN-m	48.52kN-m
Shear Force Fy	81.77 kN	65.416kN	79.50kN	75.70kN
Max B.M. And Shear Force of Column				
Forces	Rectangular	Rectangular with SW	H-shape building with SW	L-shape building with SW
Axial Force Fx	1699 kN	961.94kN	1460.20kN	1496.96 kN
Shear Force Fy	39.64kN	22.68kN	26.23kN	21.71kN
Shear Force Fz	47.40 kN	24.84kN	33.48kN	23.34kN
B.M. My	64.98 kN-m	29.33kN-m	46.31kN-m	33.62kN-m
B.M. Mz	51.40kN-m	26.92kN-m	39.52kN-m	32.67kN-m

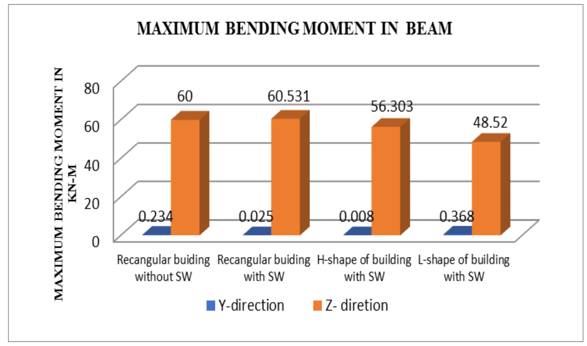

Figure 4.1 Maximum Bending Moment in Beam

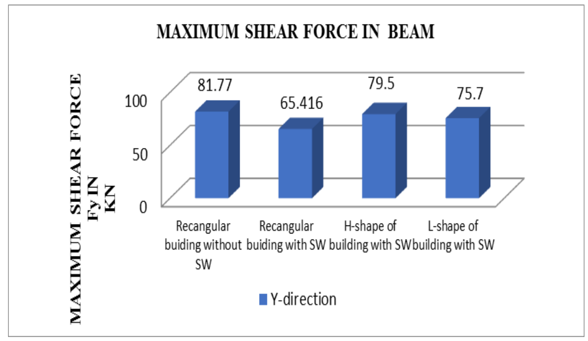

Figure 4.2 Maximum Shear Force in Beam

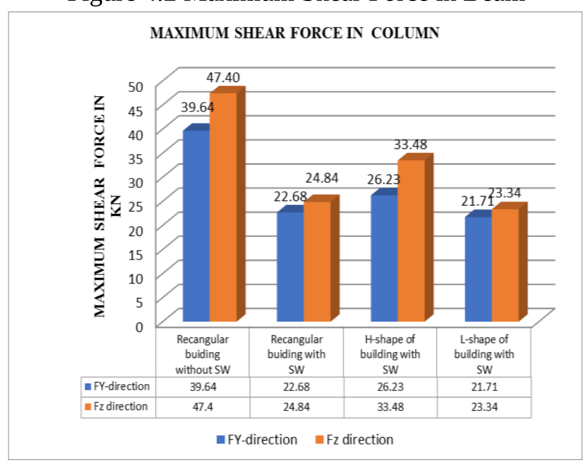

Figure 4.3 Maximum Shear Force in column

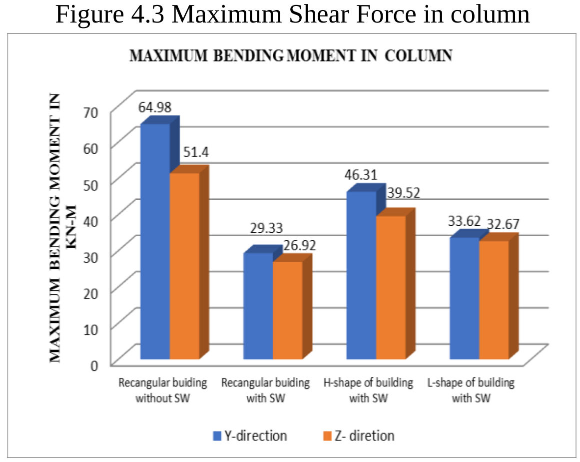

Figure 4.4 Maximum Bending Moment in Column My and Mz Direction

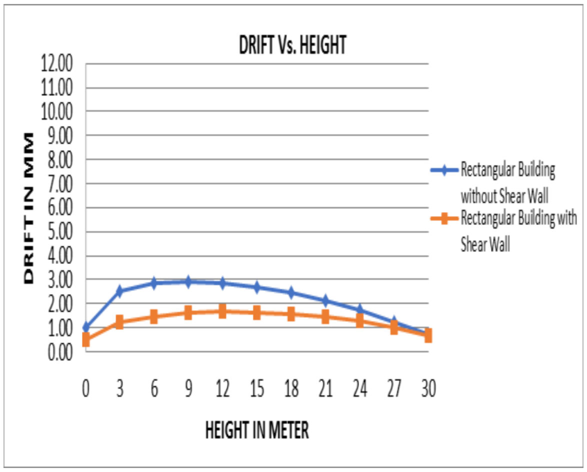

Figure 4.5 Drift vs. Height of Rectangular Building X Direction

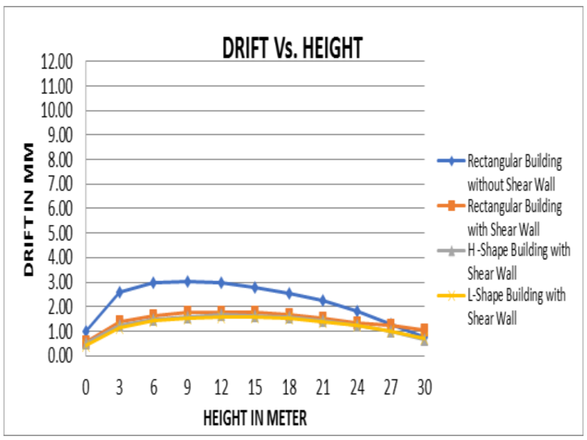

Figure 4.6 Drift vs. Height of Rectangular, H shape & L shape building

Storey drift increases with increase in height of the storey reaching to maximum value and then it again started decreasing. The maximum storey drift permitted is 0.004 times the height of storey i.e. 0.004 x 3000=12mm for all storeys.

4.2 EFFECT OF PARAMETERS STUDIED ON STOREY DRIFT:

- According to IS: 1893:2002 (part I), maximum limit for storey drift with partial load factor 1.0 is 0.004 times of storey height. Here, for 3m height and load factor of 1.5, though maximum drift will be 12mm.
- It is observed from table nos. 5.2 to 5.3 and figure nos. 5.8to 5.13 that for all the cases considered drift values follow around similar path along storey height with maximum value lying under limit the 12mm of maximum drift
- In all the models drift values are less for zones III and it goes on increases and decreasing with height the maximum value of drift is 2.922mm.in x direction and 3.03 mm in z direction for all models.

4.3 EFFECT OF PARAMETERS STUDIED ON LATERAL DISPLACEMENT:

- According to IS: 456:2000, maximum limit for lateral displacement is H/500, where H is building height. For 10 storey's building model it is 96mm.
- It is observed from table nos. 5.4 to 5.5 and figure nos. 5.14 to 5.15 that for all the models considered displacement values follow around similar gradually increasing straight path along storey height. The value of lateral displacement is maximum at the top storey and least at the base of structure

5. CONCLUSIONS

- This study reveals that the lateral displacement and the storey drift of the structure are affected by its plan shape.
- The storey force doesn't change with the shape of the building even though the lateral displacement and the storey drift change.
- Maximum lateral displacement is obtained in rectangular shape & H- shape Building is more as compared to the lateral displacement in L shape building X and Z Direction .
- It is observed that lateral displacement is more for
- Results have been proved that L -shape building is more vulnerable compare to all other different shapes.
- Maximum Bending Moment in Column Mz and My Direction. Mz is maximum in rectangular building 60.53 kN-m
- Maximum Bending Moment in Column Mz and My Direction. My is maximum in rectangular building 64.98 kN-m
- Maximum Bending Moment in Column Mz And My Direction. where prefer the rectangular building with shear wall the offer the L-shape of building

- Maximum Axial Force In column1699 kN in rectangular building where prefer the rectangular building with shear wall the offer the L-shape of building.

5.1 FUTURE SCOPE

- Finally We Can Say About in Plan Irregularity Rectangular, L Shape & H Shape Which Can Better for Drift& Displacement results in Medium Soil Condition for Zone III.
- Study the Same work by time history analysis.
- Models can be Analysed Other Soil Condition and Zone.
- Study on Different type Irregularity Used for Analysis.
- Models Result Analysis by E Tabs, SAP 2000 And Other Software and Compare The result.
- In this project, we can also say that for valuation and economical purpose L-shape of building whose less as compare to other building

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