Comparative Study of Multi-Storied Building with and without Shear Wall using STAAD-PRO

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Abstract— As the world move towards the implementation of performance based engineering philosophies in seismic design of civil engineering structure, new seismic design provisions required structural engineers to perform both linear and nonlinear analysis for the design of structures. Now a day's lot of research work is going on in static nonlinear analysis. In recent decades, shear walls structures are the most appropriate structural forms, which have caused the height of concrete buildings to be soared. Shear wall is a structural element used to resist horizontal forces parallel to the plane of the wall. Shear wall are specially designed structural walls included in the buildings to resist horizontal forces .They are mainly flexural members and usually provided in high rise building to avoid the total collapse of the high rise buildings under seismic forces. In the present work, eleven storey building 5 bay of 6m in longitudinal direction and 5 bays of 4m in transverse direction have been modeled using software STAADPRO for earthquake V zone in India. Different location and variation in thickness of shear wall are considered for studying their effectiveness in resisting lateral forces. The behaviour of building components have examined and compared in this work. Seismic characteristics in terms of displacement, story drift, and column forces have been compared with various models. From the result we conclude that, the present of shear wall at corner location with high thickness tremendously affect the seismic behavior of building.

Keywords: Shear wall, Storey Drift, Storey Displacement, Lateral loading, Lateral drift

I. INTRODUCTION

Earthquakes are the most unpredictable and devastating of all natural disasters, which are very difficult to save over engineering properties and life, against it.With the increase in height of building lateral forces on these structure also increases, and poses challenges for seismic design so these buildings are needed to be properly designed for these forces, or else it may lead to the failure of the structures. The force generated by the seismic action of an earthquake is different than other types of loads, such as gravity load and wind load. It strikes the weakest spot in the whole three dimensional building, thus cause serious damage to life and property. The behavior of a building during an earthquake depends on several factors, stiffness, adequate lateral strength and ductility, simple and regular configurations The buildings with regular geometry and uniformly distributed mass and stiffness in plan as well as in elevation suffer much less damage compared to irregular configurations. But nowadays need and demand of the latest generation and growing population has made the architects or engineers inevitable towards planning of irregular configurations.

A. Objectives of Study

The principle objectives of the study are as follows:

1) To study the optimum location of shear wall having uniform thickness throughtout the building
2) To study the performance of the building with and without shear wall.

II. METHODOLOGY

This chapter explains the methodology used in the study. It explains the methodology in details, various assumptions made, details of the structure used in the study

A. Description of Frame Structure

In this study, a G+10-storey building with grid size 3.5 m x 3.5 m is considered. The number of grids in X direction is 5 and in Y direction is 10 as shown in fig.4.1.The total plan size is 17.5 m x 35 m. This building is designed in compliance to the Indian Standard code of practice for seismic resistant design of building IS1893-2002. The buildings are assumed to be fixed at the base and the floors acts as rigid diaphragms. The height of Ground floor is 4.5m and above the ground is 3.5m. The Depth of foundation is 2.5 m Models are studied for zones III comparing lateral displacement, story drift, shear force and bending moment zones for all models.

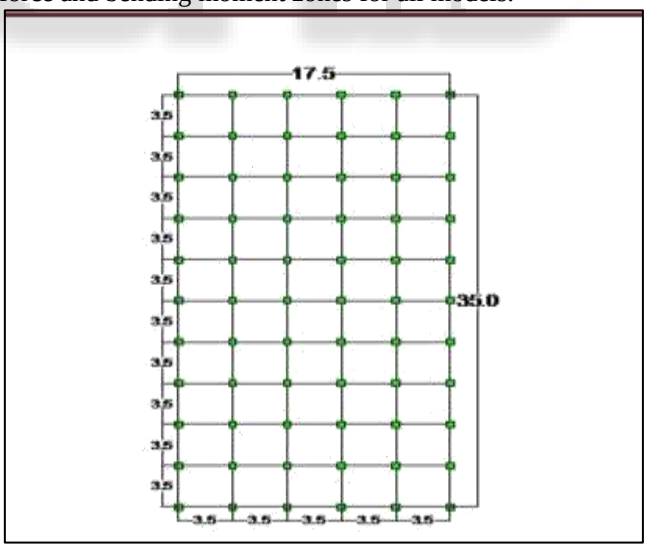

Fig. 1. Plan of the building

B. Structural Plan and 3-D View of Different Models.

1) Model without Shear Wall

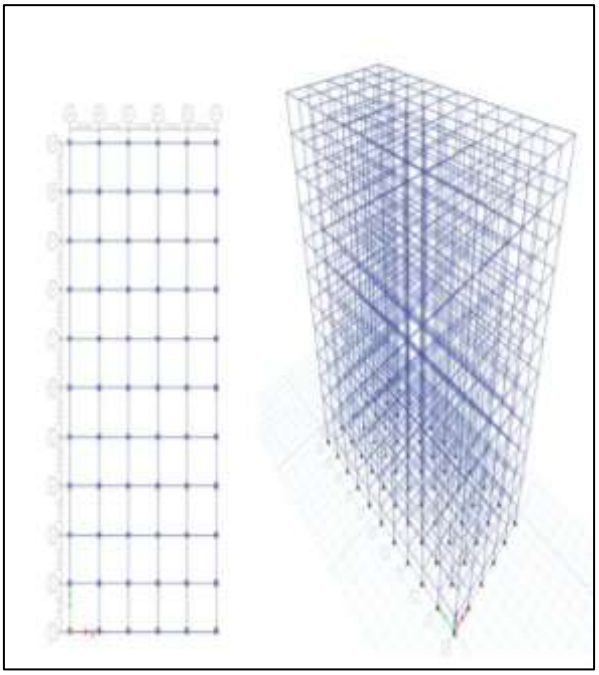

Fig. 2: Model without Shear wall

2) Model with Corner Shear Wall

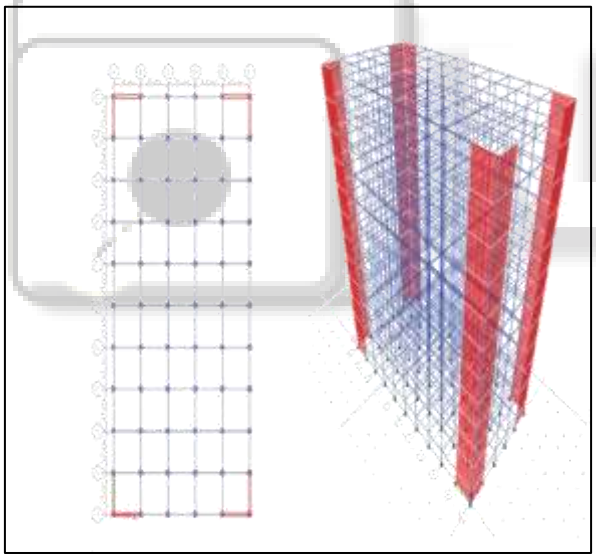

Fig. 3: Model with corner Shear wall

III. RESULTS & DISCUSSION

A. Displacements In X and Y Directions

Storey	Without Shear	Corner Shear
0	2.465	0.504
1	12.97	2.165
2	20.004	3.742
3	26.691	5.555
4	33.215	7.517
`5	39.492	9.541
6	45.388	11.563
7	50.742	13.526
8	55.374	15.279
9	59.085	17.058
10	61.691	18.509
11	63.214	19.855

Table 1. Displacement in X direction

Storey	Without	Corner
0	2.606	0.507
1	13.671	2.115
2	20.664	3.663
3	27.265	5.443
4	33.67	7.355
5	39.794	9.319
6	45.509	11.264
7	50.655	13.144
8	55.055	14.908
9	58.51	16.524
10	60.822	17.967
11	62.002	19.29

Table 2: Displacement in Y direction

B. Storey Drift in X and Y Direction

Storey	Without	Corner
0	0.1694	0.0288
1	0.6974	0.0143
2	0.4665	0.0127
3	0.4461	0.0139
4	0.435	0.0147
5	0.4184	0.015
6	0.3931	0.0151
7	0.357	0.0149
8	0.3088	0.0144
9	0.2475	0.0134
10	0.1739	0.0111
11	0.1005	0.0041

Table 3. Storey drift in X direction

Storey	Without	Corner
0	0.1781	0.0288
1	0.7342	0.0134
2	0.4649	0.0117
3	0.4404	0.0128
4	0.427	0.0134
5	0.4083	0.0135
6	0.3809	0.0133
7	0.3431	0.0129
8	0.2933	0.0122
9	0.2303	0.0114
10	0.1543	0.0102
11	0.0768	0.0054

Table 4. Storey drift in Y direction

IV. CONCLUSIONS

1) The presence of shear wall affects the seismic behaviour of frame structure to large extends and shear wall increases the strength and stiffness of the structure, as it is clear from this study that models with shear wall are having better response to earthquake as compared to model without shear wall
2) From this study we have concluded that the location of shear wall largely affects the behaviour of building in earthquake zone area.

3) Providing shear wall at adequate locations substantially reduces the displacements due to earthquakes, percentage of lateral drift and displacement also depends on location of shear wall.

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