International Journal of Research
Available at https://journals.pen2print.org/index.php/ijr/
e-ISSN: 2348-6848
p-ISSN: 2348-795X
Volume 06 Issue 03
March 2019

Seismic Analysis of Rcc Building with Shear Wall at Different Locations Using Staad Pro

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ABSTRACT *Shear wall systems are one of the most commonly used lateral load resisting systems in buildings. Shear walls are one of the most efficient lateral force resisting elements in buildings. In the seismic design of buildings, reinforced concrete structural walls, or shear walls, act as major earthquake resisting members. Shear walls have very high in plane stiffness and strength, which can be used to simultaneously resist large horizontal loads and support gravity loads, making them quite advantageous in many structural engineering applications. They are mainly flexural members and usually provided in buildings to avoid the total collapse of the buildings under seismic forces. The properties of these seismic shear walls dominate the response of the buildings, and therefore, it is important to evaluate the seismic response of the walls appropriately.*

In this study a 8 storey building is taken under consideration. Four different Model of RCC building are used, one with no shear wall and other two models with different position of shear wall. Results will be obtained from analysis and plotted to compare and to have knowledge of behavior of RCC framed structures with shear walls is subjected to earthquake load in zone V. The parameters like storey drift, lateral displacement, and base shear will be studied and suitable location of shear wall will be determined among these models. This study also incorporates how the shear force, bending moment for beam and axial Force for column vary with change in the position of RC shear wall. The whole analysis is done on STAAD. Pro V8i software.

Key words: Shear wall, gravity loads, seismic forces, earthquake load, storey drift, lateral displacement, base shear, shear force, bending moment.

1.INTRODUCTION

The tallness of a building is relative and cannot be defined in absolute terms either in relation to height or the number of stories. But, from a structural engineer's point of view the high rise building can be defined as one that, by virtue of its height, is affected by lateral forces due to wind or earthquake or both to an extent that they play an important role in the structural design. Shear walls are a sort of structural system that has lateral resistance to the building or structure. They are vertical components of the structure i.e. the horizontal force resisting system. They are made to counteract the result of lateral masses engaged on the structure. In residential construction, shear walls are straight external walls that usually provide all of the lateral support for the building. The design approach adopted in the Indian Code IS 1893(Part I): 2002 'Criteria for Earthquake Resistant

Design Of Structures' is to ensure that structures possess at least a minimum strength to withstand minor earthquake occurring frequently, without damage; resist moderate earthquakes without significant structural damage though some non-structural damage may occur; and aims that structures withstand major earthquake without collapse. Reinforced concrete (RC) buildings often have vertical plate-like RC walls called Shear Walls in addition to slabs, beams and columns. These walls generally start at foundation level and are continuous throughout the building height. Their thickness can be as low as 150mm, or as high as 400mm in high rise buildings. Shear walls are usually provided along both length and width of buildings. Shear walls are like vertically-oriented wide beams that carry earthquake loads downwards to the foundation. Shear walls in high seismic regions require special detailing. Shear wall buildings are a popular choice in many earthquake prone countries, like Chile, New Zealand and USA. Shear walls are easy to construct, because reinforcement detailing of walls is relatively straight-forward and therefore easily implemented at site. Shear walls are efficient, both in terms of construction cost and effectiveness in minimizing earthquake damage in structural and nonstructural elements.

OBJECTIVES OF THE STUDY

The following are the main objectives of the project

1. To investigation the seismic conduct of multi story working by utilizing IS 1893:2002
2. To contrast the multi story structures and without shear shear wall at various areas on multi story Building with customary and sporadic shapes .
3. To study the values of Story Drift, Shear, Bending, Building deflection of structures without shear wall at various areas on multi story Building with standard and unpredictable shapes.
4. To examination the structures in STAAD Pro V8i Software.

2. LITERATURE REVIEW

Asnhuman et al., (2011) - They have conducted study on research on lateral-load resisting system in high rise building. From the study, it was observed that shear wall was very high-in plane stiffness and strength, which can resist large horizontal loads and support gravity loads. Elastic and elasto-plastic analysis was performed using both STAAD pro 2004 and SAP V 10.0.5 (2000) software package. Parameters like shear forces, bending moment and storey drift were computed in both the cases and also for different location of shear wall.

Mohd et al., (2015) - They have studied the G+15 building structure by using STAAD Pro vi8 software in different zones. This study included the main consideration factor which affects the structure to perform poorly during earthquake, in order to achieve the appropriate behavior during future earthquake. IS code 1893(Part 1):2002 was used for seismic analysis. A comparatively analysis was done on base shear, displacement, axial load , moment in Y and Z direction in column and shear force , maximum bending moment and maximum torsion in beam. Modeling was done using STAAD Pro vi8 software.

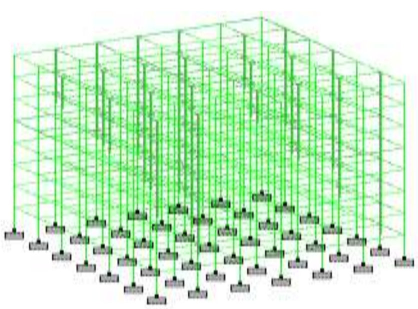
3. PROBLEM STATEMENT AND MODELS OF BUILDINGS

The preliminary data as is taken up for this study

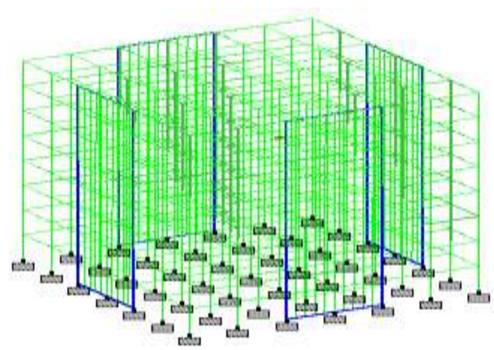
1. Number of storeys : 8
2. Plan size : 18Mx18m
3. Size of columns : 450mmX450mm
4. Size of beams :300mmX300mm
5. Shear wall thickness :200mm
6. Total building height : 24m
7. Floor to floor height :3m
8. Grade of concrete and steel : M30 grade and Fe550
9. Support condition : Fixed supports
10. Dead Load (DL) and Live load (LL) : As per IS 875 (Part 1) (1987) and IS 875 (Part 2) (1987)
11. Seismic load (SL) : As per IS 1893 (Part 1) (2002) Approach
12. DL : Self weight of the structure, Floor load and Wall loads
13. LL : Live load 3.5 KN/sq.m is considered for floor weight
14. SL : Zone: V (Z=0.36)
15. Rock/ soil type : Medium Rock and Soil site factor : 1
16. Response reduction factor : 5
17. Importance factor : 1
18. Damping : 0.05%

Building Models in STAAD Pro Software

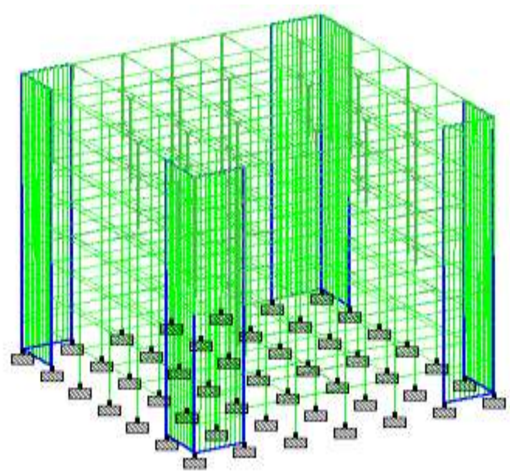
Building without shear walls



Building with shear wall at center



Building with shear wall at corner



4. RESULTS AND ANALYSIS

Story Drift

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Story Number	Drift for general building in mm	Drift for shear wall at center building in mm	Drift for shear wall at corner building in mm
Base	0	0	0
1st story	0.4336	0.1372	0.1626
2nd story	1.2229	0.3882	0.4624
3rd story	2.0852	0.6647	0.7954
4th story	2.9276	0.9465	1.0549
5th story	3.6997	1.3365	1.5837
6th story	4.357	1.6654	1.9758
7th story	4.8565	1.8743	2.2482
8th story	5.1756	1.9445	2.3291

Shear in X Direction

Story Number	Shear force for general building in kN	Shear force for shear wall at center building in kN	Shear force for shear wall at corner building in kN
1st story	34.994	8.957	1.932
2nd story	51.141	16.621	1.076
3rd story	59.05	21.203	3.138
4th story	62.866	33.588	4.171
5th story	63.319	43.343	6.085
6th story	60.125	37.586	1.334
7th story	54.754	28.612	13.29
8th story	40.991	19.433	17.006

Shear in Y Direction

Story Number	Shear force for general building in kN	Shear force for shear wall at center building in kN	Shear force for shear wall at corner building in kN
1st story	1.423	0.462	0.328
2nd story	2.031	2.731	1.932
3rd story	2.738	7.799	5.113
4th story	3.893	13.445	7.129
5th story	5.51	8.166	4.787
6th story	7.457	4.057	1.478
7th story	9.509	6.722	2.658
8th story	10.557	14.559	6.219

Bending in X Direction

Story Number	Bending Moment for general building in Kn-m	Bending Moment for shear wall at center building in Kn-m	Bending Moment for shear wall at corner building in Kn-m
1st story	58.673	21.465	10.883
2nd story	82.727	33.013	9.604
3rd story	94.589	40.101	3.503
4th story	100.439	58.599	1.125
5th story	101.352	73.096	17.338
6th story	96.878	64.67	6.101
7th story	89.348	51.271	11.905
8th story	69.008	38.354	16.331

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p-ISSN: 2348-795X
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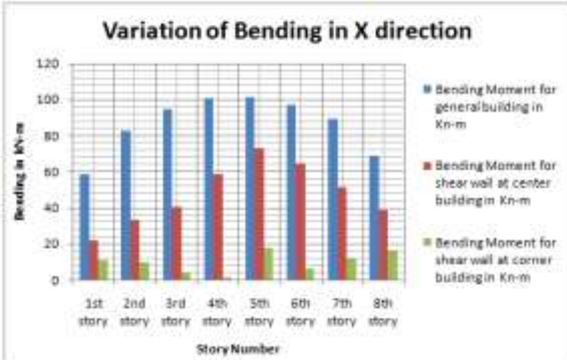
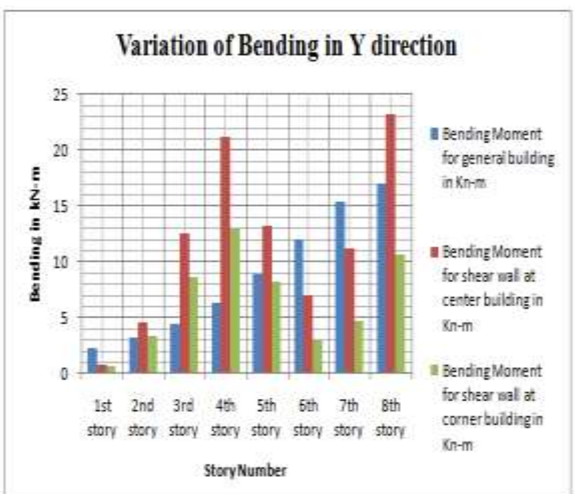


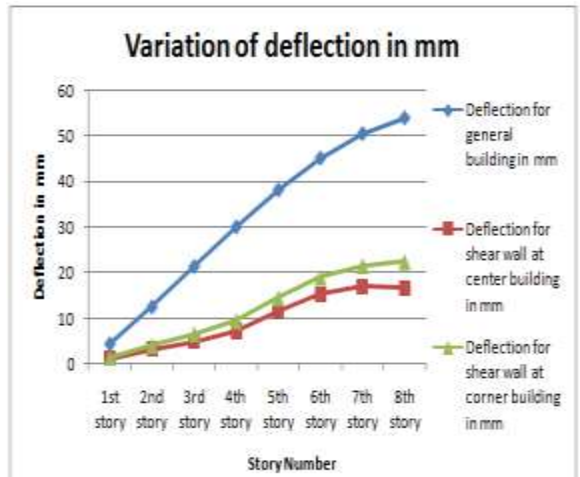
Bending in Y Direction

Story Number	Bending Moment for general building in Kn-m	Bending Moment for shear wall at center building in Kn-m	Bending Moment for shear wall at corner building in Kn-m
1st story	2.251	0.862	0.647
2nd story	3.279	4.568	3.355
3rd story	4.47	12.538	8.667
4th story	6.356	21.23	12.956
5th story	8.964	13.304	8.265
6th story	12.082	7.069	2.909
7th story	15.341	11.216	4.75
8th story	17.026	23.232	10.728



Deflection of Building

Story Number	Deflection for general building in mm	Deflection for shear wall at center building in mm	Deflection for shear wall at corner building in mm
1st story	4.571	1.188	1.476
2nd story	12.642	3.186	4.064
3rd story	21.454	5.059	6.702
4th story	30.135	7.228	9.558
5th story	38.187	11.557	14.538
6th story	45.14	15.38	19.072
7th story	50.511	17.032	21.629
8th story	53.926	16.799	22.501



5. CONCLUSIONS

From this study the following conclusions were made

1. Top deflection was reduced and reached within the permissible deflection after providing the shear wall in shorter direction.
2. The shear wall location was found to be more effective towards shorter column as compared to other locations.
3. Shear wall symmetrically in the outer most moment resisting frames give better performance for regular shape building.

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4. The value of drift is found to be lower value for building with shear wall at center than remaining cases.
5. The values of Shear in X Direction and Y Direction found lower value for building with shear wall at corner position than remaining buildings.
6. The values of Bending in X Direction and Y Direction found lower value for building with shear wall at corner position than remaining buildings.
7. The value of deflection of building is found to be lower value for building with shear wall at center than remaining cases
8. It was observed for a particular opening in wall when the opening position is shifted from one position to other position.
9. From this study it was concluded that increase in the percentage of Shear wall results in decrease in the drift, deflection and increases the Shear force, bending moment.

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