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Comparative Study of Multi-Storied RC building with and without Shear Wall

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Abstract - *In high rise buildings earthquake forces should be considered before determining the safety of a structure. Hence stiffness of columns must be enough to stay safe during an earthquake, and it was found that for providing high stiffness in the columns, the size of columns is very large and is difficult to construct large size columns due to congestion of space. Hence an alternative was found for high rise buildings which are termed as a shear wall. Shear wall behaves like a wide column. A 3-D analysis of shear wall structures has been carried out using the ETABS software package. Different models have been drawn by adopting different locations and configurations of shear walls. Different parameters studied are Storey Displacement and Storey Drift. Based on these parameters, the best model has been suggested.*

1. INTRODUCTION

Generally, shear wall is often outlined as structural vertical member that's able to resist combination of shear, moment and axial load elicited by lateral load and gravity load transfer to the wall from alternative support. Shear walls have high stiffness and strength, creating them quite advantageous in several structural engineering applications. The use of shear wall structure has gained quality in a high rise building structure, particularly within the construction of a service flat or office/ industrial tower. It's been well-tried that this method provides an economical structural system for multi construction building within the vary of 30-35 storeys.

2. LITERATURE REVIEW

When shear walls are situated in an advantageous position and configuration in a building they can form a very efficient lateral load resisting system. The various authors investigated the study on parameters like lateral displacement, storey drift and member forces to find out the ideal location and configuration of shear walls and braces in the building. This chapter includes the studies carried out by different authors and conclusions of their study.

3. METHODOLOGY

When a structure is subjected to ground motions in an earthquake, it responds by vibrating. The random motion of the ground caused by an earthquake can be resolved in any three mutually perpendicular directions. This motion causes the structure to vibrate in all three directions. The predominant direction of shaking is horizontal.

As the ground on which a building rests is displaced, the base of the building moves suddenly with it, but the roof tends to stay in its original position (inertia). When designing a building according to the codes, the lateral force is considered in each of the two orthogonal horizontal directions of the structure.

3. DESCRIPTION OF CONSIDERED MODEL

Table 2: Load cases

Load cases	Type	Details
Dead	Dead load	Use self-weight multiplier
Floor	Live load	Slab: 200mm
Storey	Live load	Slab: 200 mm Beams: 600x600 mm
Earthquake	Seismic load	Is:1893:2002 response reduction factor = 5

Table 3: Building Details

S.NO	PARTICULARS	DATA
1	No. Of storeys	15
2	Plan dimension	20x20 m
3	Storey height	3.0 m
4	Grade of concrete	M30
5	Grade of steel	Fe415
6	Thickness of slab	0.2 m
7	Beam size	0.6x0.6 m
8	Column size	0.6x0.6 m
9	Seismic zone	2
10	Seismic factor	0.1
12	Top storey load	1.5 KN/m2
14	Floor/cover load	1.0 KN/m2

The following are the models to be considered for analysis of an R.C building with shear walls at various locations.

I. Bare frame (no shear walls) M1

II. Shear wall at central core M2

III. Shear walls at corners M3

IV. Shear walls at edge faces M4

V. Shear walls at core + corners M5

VI. Shear walls at core + edges M6

4. RESULTS AND DISCUSSION

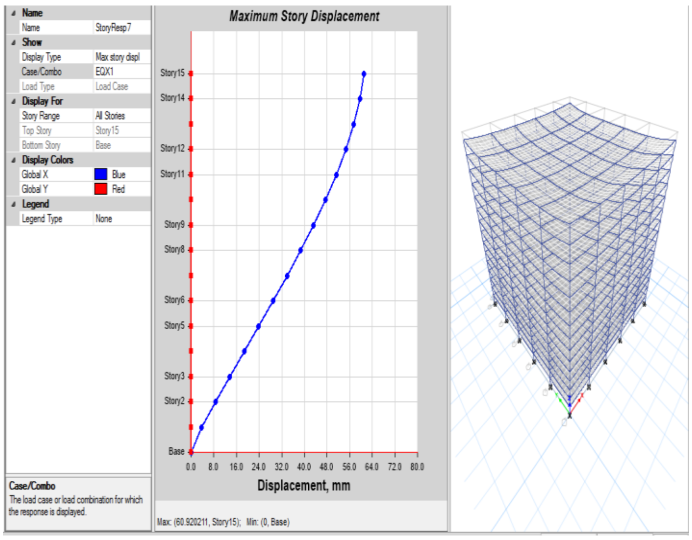


Figure 4.1: Model 1 storey displacement plot

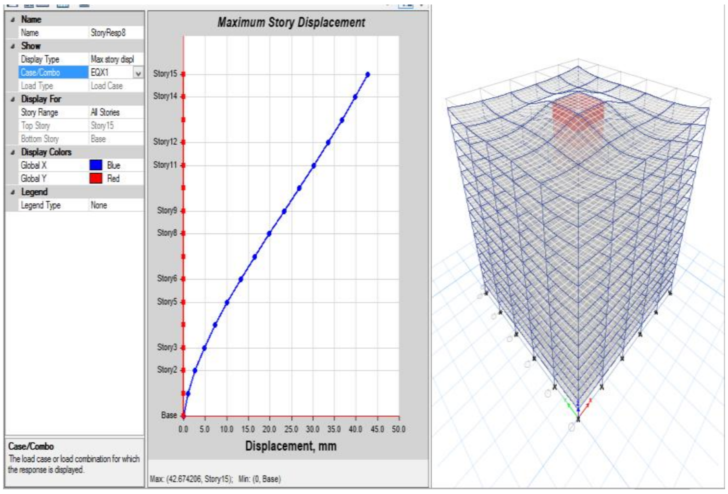


Figure 4.2: Model 2 storey displacement plot

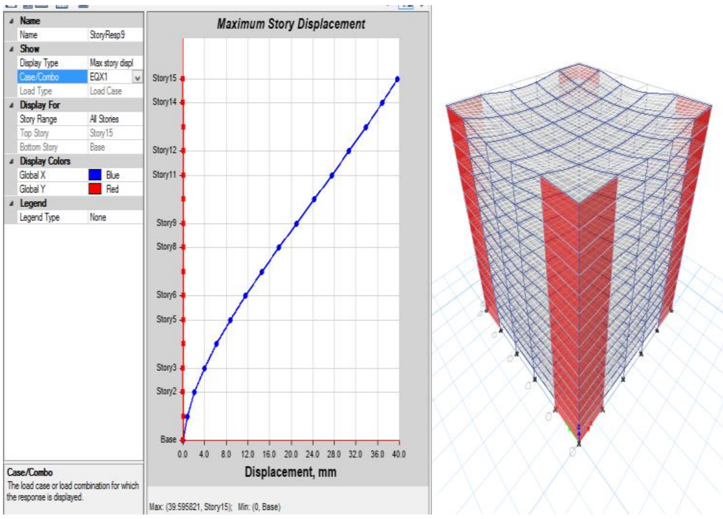


Figure 4.3: Model 3 storey displacement plot

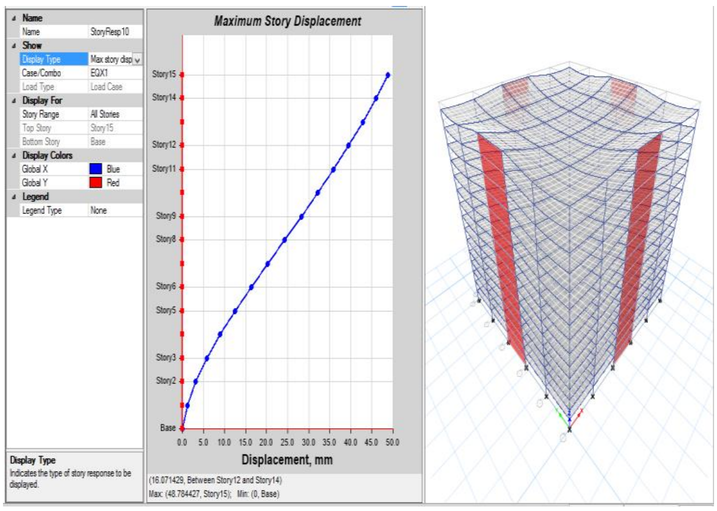


Figure 4.4: Model 4 storey displacement plot

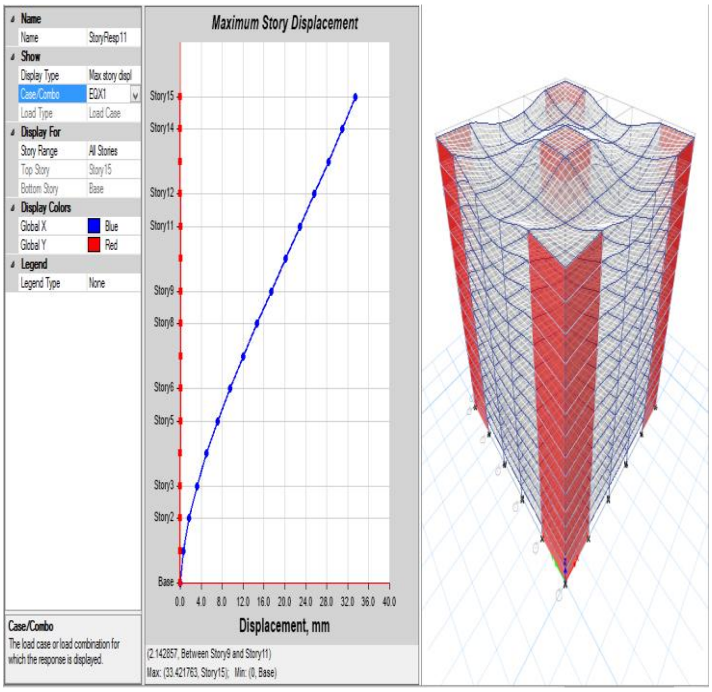


Figure 4.5: Model 5 storey displacement

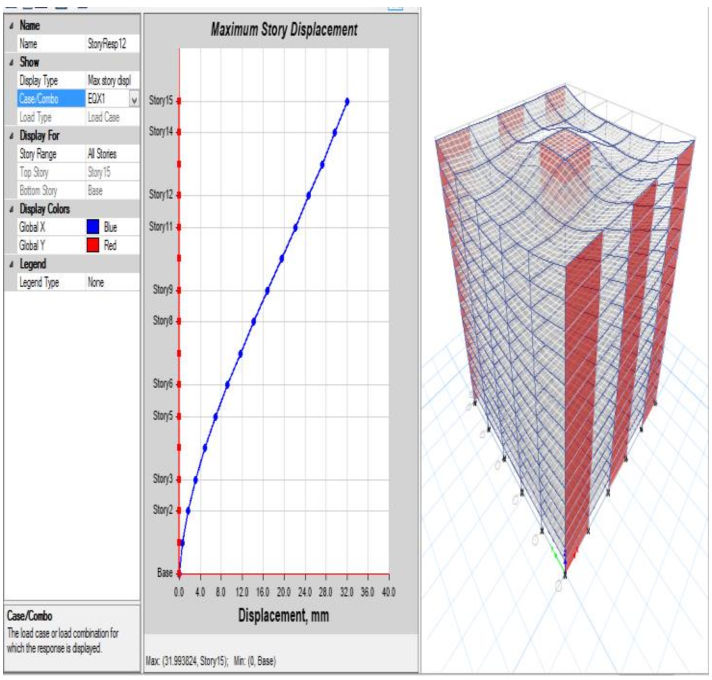
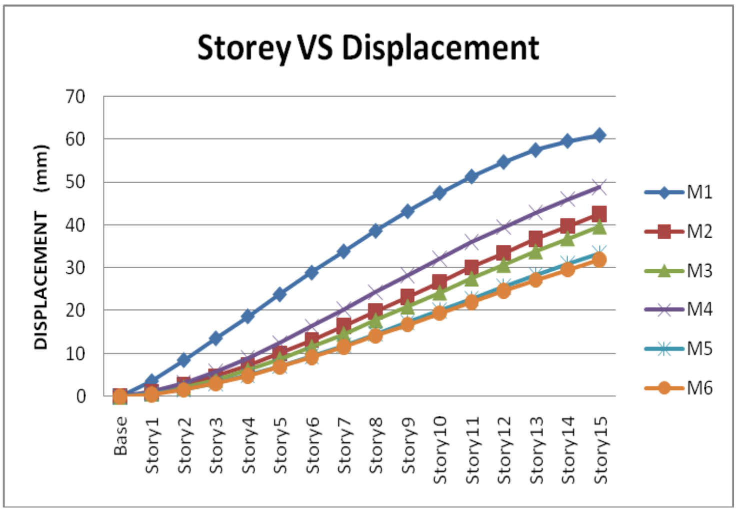
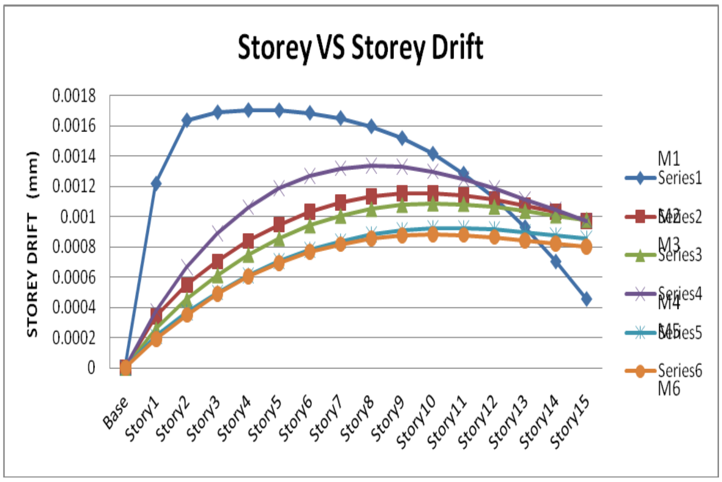


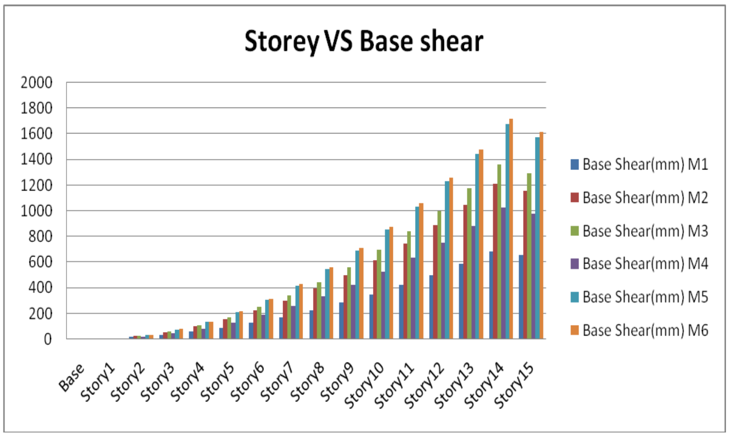
Figure 4.6: Model 6 storey displacement plot



Graph 4.1 storeys vs storey displacement(mm)



Graph 4.2 storeys vs storey drift



Graph 4.3 storeys vs base shear (kN)

Table 4.1 Combination of storey displacement plots of above six models

Displacement(mm)						
Storey	**M1**	**M2**	**M3**	**M4**	**M5**	**M6**
Story15	60.92	42.674	39.596	48.784	33.422	31.994
Story14	59.556	39.841	36.802	45.955	30.935	29.67
Story13	57.447	36.752	33.792	42.816	28.312	27.216
Story12	54.658	33.529	30.681	39.467	25.623	24.693
Story11	51.288	30.194	27.486	35.908	22.88	22.107
Story10	47.435	26.777	24.238	32.161	20.111	19.478
Story9	43.189	23.319	20.976	28.264	17.347	16.836
Story8	38.634	19.866	17.746	24.275	14.626	14.216
Story7	33.846	16.474	14.595	20.262	11.987	11.659
Story6	28.893	13.201	11.58	16.305	9.476	9.211
Story5	23.837	10.111	8.757	12.497	7.139	6.925
Story4	18.73	7.274	6.189	8.944	5.029	4.855
Story3	13.62	4.763	3.946	5.768	3.198	3.065
Story2	8.553	2.656	2.115	3.112	1.709	1.617
Story1	3.655	1.015	0.769	1.118	0.62	0.572
Base	0	0	0	0	0	0

Table 4.2 Combination of storey drifts of above six models

Storey drift(mm)						
Storey	**M1**	**M2**	**M3**	**M4**	**M5**	**M6**
Story15	0.000456	0.000971	0.000979	0.000974	0.000858	0.000798
Story14	0.000703	0.00103	0.001007	0.001046	0.000878	0.000818
Story13	0.00093	0.001074	0.001037	0.001116	0.000896	0.000841
Story12	0.001123	0.001112	0.001065	0.001186	0.000914	0.000862
Story11	0.001284	0.001139	0.001083	0.001249	0.000923	0.000876
Story10	0.001415	0.001153	0.001087	0.001299	0.000921	0.000881
Story9	0.001518	0.001151	0.001077	0.00133	0.000907	0.000873
Story8	0.001596	0.001131	0.00105	0.001338	0.00088	0.000852
Story7	0.001651	0.001091	0.001005	0.001319	0.000837	0.000816
Story6	0.001685	0.00103	0.000941	0.00127	0.000779	0.000763
Story5	0.001702	0.000946	0.000856	0.001186	0.000704	0.000692
Story4	0.001703	0.000838	0.000748	0.001061	0.00061	0.000602
Story3	0.001689	0.000703	0.000613	0.000889	0.000498	0.000488
Story2	0.001636	0.000547	0.000453	0.000665	0.000366	0.000349
Story1	0.001218	0.000338	0.000256	0.000373	0.000207	0.000191
Base	0	0	0	0	0	0

Table 4.3 Combination of Base shear(kN)

Base Shear(kN)						
Storey	**M1**	**M2**	**M3**	**M4**	**M5**	**M6**
Story15	657.7704	1159.491	1293.437	980.0952	1573.285	1619.728
Story14	681.7341	1212.941	1365.225	1025.275	1675.006	1717.089
Story13	587.8218	1045.852	1177.159	884.038	1444.266	1480.551
Story12	500.8659	891.14	1003.023	753.2631	1230.617	1261.535
Story11	420.8665	748.8052	842.8177	632.9503	1034.06	1060.04
Story10	347.8235	618.8472	696.5435	523.0994	854.595	876.0657
Story9	281.7371	501.2663	564.2002	423.7105	692.222	709.6132
Story8	222.6071	396.0622	445.7878	334.7836	546.9408	560.682
Story7	170.4335	303.2351	341.3063	256.3187	418.7516	429.2722
Story6	125.2165	222.785	250.7557	188.3158	307.6542	315.3837
Story5	86.9559	154.7118	174.1359	130.7749	213.6488	219.0164
Story4	55.6518	99.0156	111.447	83.6959	136.7352	140.1705
Story3	31.3041	55.6963	62.6889	47.0789	76.9136	78.8459
Story2	13.9129	24.7539	27.8617	20.924	34.1838	35.0426
Story1	3.4782	6.1885	6.9654	5.231	8.546	8.7607
Base	0	0	0	0	0	0

5. CONCLUSIONS

From the above results, it was concluded that more number of shear walls more will be the resistance. The horizontal displacement of 15 storey building with shear wall at core+edge places is lesser compared to other models. Larger the width of the shear wall more will be the resistance. It is observed that more the base shear more will be the resistance. Hence, from the above results, it can be concluded that model 6 is having least storey displacement with the maximum number of shear wall which resists more lateral loads compared to other models.

6. ACKNOWLEDGEMENT

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7. FUTURE SCOPE

- In this paper we have considered a building of 15 storeys only, we can also consider buildings with more number of storeys.
- In this paper, we considered the building with a regular plan and assumes seismic load acts in a unidirectional. It also to carry out for irregular plan and load acts in a multi-directional.

7. REFERENCES

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