

Study of Shear Walls in Different Locations of Multistoried Building with Uniform Thickness in Seismic Zone III

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Abstract- In the seismic design of buildings, reinforced concrete structure walls, or shear walls, act as a major earthquake resisting members. Structural walls provide a resistance against the lateral loads system. The properties of these seismic shear walls dominate the response of the building, it is important to evaluate the seismic response of the walls appropriately. In this project we are considering 5x5 bay plan with G+14 storey height of building to be constructed in zone III by providing shear walls of uniform thickness (200mm) in various locations of buildings. "Linear equivalent static method" analysis of the building is done using ETABS 2015. In this present study, main focus is to determine the solution for shear wall location in multi storey building. Effectiveness of shear wall has been studied with the help of five different models. Model-I is bare frame structural system and other four models are dual type structural system. An earthquake load is applied to a building of 15 stories located in zone III. The building act as a vertical cantilever in the form of separate planner walls.

Index Terms- Location of Shear wall, ETABS, Earthquake resistant structure, Equivalent Static analysis.

I. INTRODUCTION

1.1GENERAL

Shear wall may be defined as structural elements, which provide strength, stiffness and stability against lateral loads deriving strength and stiffness mainly their shape in many cases, high rise buildings are designed as a framed structure with shear walls that can effectively resist horizontal forces.

Shear walls are one of the most efficient lateral force resisting elements in multi-storeyed buildings. Many modern constructions use shear wall as main source for lateral force resistance and can also be used for

seismic rehabilitation of existing buildings. Since plastic hinges forms in the beams and not in the wall, shear wall frame interaction system is more reliable. In addition, benefit of reducing lateral sway in the building under seismic loading can be available using shear wall.

The use of shear wall structure has gained popularity in high rise building structure, especially in the construction of service apartment or office/commercial tower. It has been proven that this system provides efficient structural system for multi-storey building in the range of 30-35 storey's (MARSONO & SUBEDI, 2000). In the past 30 years of the record service history of tall building containing shear wall element, none has collapsed during strong winds and earthquakes (FINTEL, 1995).

1.2RC SHEAR WALL

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. The overwhelming success of buildings with shear walls in resisting strong earthquakes is summarized in the quote, "We cannot afford to build concrete buildings meant to resist severe earthquakes without shear walls." as said by Mark Fintel, a noted consulting engineer in USA. RC shear walls provide large strength and stiffness to buildings in the direction of their orientation, which significantly reduces lateral sway of the building and thereby reduces damage to structure and its contents. Since shear walls carry large horizontal earthquake

forces, the overturning effects on them are large. Shear walls in buildings must be symmetrically located in plan to reduce ill-effects of twist in buildings. They could be placed symmetrically along one or both directions in plan. Shear walls are more effective when located along exterior perimeter of the building such a layout increases resistance of the building to twisting.

1.3 FUNCTION OF SHEAR WALL

Shear wall systems are one of the most commonly used lateral load resisting systems in high-rise buildings. 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. Shear walls must provide the necessary lateral strength to resist horizontal earthquake forces. When shear walls are strong enough, they will transfer these horizontal forces to the next element in the load path below them. These other components in the load path may be other shear walls, floors, foundation walls, slabs or footings. Shear walls also provide lateral stiffness to prevent the roof or floor above from excessive sideways. When shear walls are stiff enough, they will prevent floor and roof framing members from moving off their supports. Also, buildings that are sufficiently stiff will usually suffer less non-structural damage.

Use of shear wall gives a structurally efficient solution to stiffen a building. The main function of shear wall is to increase the rigidity for lateral load resistance in the tall buildings. Shear walls are commonly used as a vertical structural element for resisting the lateral loads that may be induced by the loads due to wind and earthquake. Besides they also carry gravity loads. A well-designed system of shear wall in building frame improves seismic performance significantly. A box system structure that consists of reinforced concrete walls and slabs are used in high rise building.

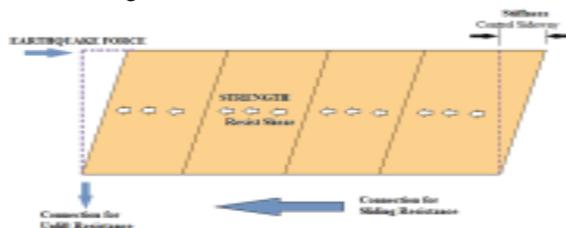


Fig.1.1 Functions of shear wall

The properties of seismic shear walls dominate the response of the buildings, and therefore it is important to evaluate the seismic response of the shear walls appropriately. Also, it is necessary to find out the effective location of shear wall in the structure.

2. OBJECTIVES

The principal objectives of the study are as follows:

1. To study the Optimum location of shear wall having uniform thickness throughout the building.
2. To study the storey displacement of structure for different location of shear wall.
3. To study the storey drift for different location of Shear wall.
4. To study the storey shear for different location of shear wall.
5. To study the mode shapes for different location of shear wall.

3. BUILDING CONFIGURATION AND METHODOLOGY

The present study is an effort towards analysis of the structure located on a flat ground during the earthquake. An ordinary moment resisting building of G+14 stories located over a medium soil is considered. The number of bays will be kept as 5 along both direction and the bay size will be kept as 4m with the storey height being 3m. The building will be analysed considering zone III by static equilibrium method using ETABS 2015 software. Three-dimensional space frame analysis will be carried out for five different building configurations resting on flat ground under the action of seismic load. The configurations include the thickness of shear wall like 200mm and height building of 15 storeys.

The Various building models considered are:

- Model 1: Bare frame building.
- Model 2: Building with shear wall at corner.
- Model 3: Building with shear wall at mid span.
- Model 4: Building with shear wall at 2nd grid corner.
- Model 5: Building with shear wall at 2nd mid span.

3.1 METHODOLOGY

To study and evaluate the behaviour of reinforced concrete buildings resting on the sloping ground, equivalent static analysis of a RC-building with fixed base is done considering different types of shear walls using ETABS. To study behaviour of shear wall with different thickness and determining percentage of reinforcement on sloping ground. Equivalent static Analysis of all building models, in terms of base shear and roof displacement is presented and compared with the different thickness of shear wall.

The material and sectional properties in the analysis of different building compositions are as per IS 456:2000. Dead loads and live loads are compared as per IS 875 (part 1):1987 and IS 875(part 2):1987 respectively. Lateral load parameters are considered confirming to IS 1893 (Part 1): 2002. The load combinations are considered as per IS 875 (Part 5): 1987.

3.2 SOFTWARE

The software used in this program is ETABS 2015. ETABS is a special purpose computer program developed specifically for building systems. The concept of special purpose programs for building type structures was introduced more than 35 years ago [R. W. Clough, et al., 1963]. However, the need for special purpose programs, such as ETABS, has never been more evident as Structural Engineers put nonlinear static and dynamic analysis into practice and use the greater computer power available today to create larger, more complex analytical models.

With ETABS, creating and modifying a model, executing the analysis, design, and optimizing the design are all done through a single interface that is completely integrated within Microsoft Windows. Graphical displays of the results, including real-time display of time-history displacements, are easily produced. Printed output, to a printer or to a file, for selected elements or for all elements, is also easily produced. This program provides a quantum leap forward in the way models are created, modified, analysed and designed.

The analytical capabilities of ETABS are just as powerful, representing the latest research in numerical techniques and solution algorithms.

3.3 ANALYSIS CONSIDERATION

In the 3D analysis of various types of models following methods are studied.

- Equivalent Static Method

3.3.1 Equivalent Static method

The Equivalent Static method is the simplest method of analysis and requires less computational effort because the forces depend on the code based fundamental period of structures with some empirical modifier. The design base shear shall first be computed as a whole, and then be distributed along the height of buildings based on simple formulae appropriate for buildings with regular distribution of mass and stiffness. The design lateral force obtained at each floor level shall be distributed to individual lateral load resisting elements depending upon floor diaphragm action.

The design lateral force or design base shear and the distribution are given by some empirical formulae given in the IS 1893.

3.3.2 Design Seismic Base Shear

The total design lateral force or design seismic base shear (VB) along any principal direction shall be determined by the following expression:

$$VB = Ah \times W$$

Where,

Ah = horizontal acceleration spectrum.

W = seismic weight of all the floors.

3.3.3 Fundamental Natural Period

The approximate fundamental natural period of vibration (T), in seconds, of a moment-resisting frame building without brick in the panels may be estimated by the empirical expression:

$$T = 0.075 h^{0.75} \text{ for RC frame building}$$

$$T = 0.085 h^{0.75} \text{ for steel frame building}$$

Where,

h = Height of building, in m.

This excludes the basement storey, where basement walls are connected with the ground floor deck or fitted between the building columns. But it includes the basement storey, when they are not so connected.

The approximate fundamental natural period of vibration (T), in seconds, of all other buildings, including moment-resisting frame buildings with brick lintel panels, may be estimated by the empirical Expression.

$$T = 0.09h / \sqrt{d}$$

Where,

h = Height of building

d = Base dimension of the building at the plinth level, in m, along the considered direction of the lateral force.

3.3.4 Distribution of Design Force

Vertical Distribution of Base Shear to Different Floor Level The design base shear (V_B) shall be distributed along the height of the building as per the following.

$$Q_i =$$

Expression :-

Q_i = Design lateral force at floor i .

W_i = Seismic weight of floor i .

H_i = Height of floor i measured from base.

n = Number of storey in the building is the number of levels at which the masses are located.

Distribution of Horizontal Design Lateral Force to Different Lateral Force Resisting Elements in case of buildings whose floors are capable of providing rigid horizontal diaphragm action, the total shear in any horizontal plane shall be distributed to the various vertical elements of lateral force resisting system, assuming the floors to be infinitely rigid in the horizontal plane. In case of building whose floor, diaphragms cannot be treated as infinitely rigid in their own plane, the lateral shear at each floor shall be distributed to the vertical elements resisting the lateral forces, considering the in-plane flexibility of the diagram.

4. MODELS CONSIDERED FOR ANALYSIS

4.1 Bare Frame

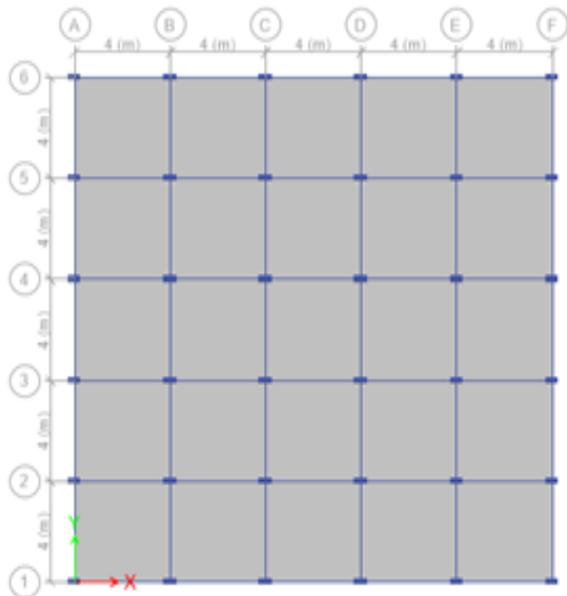


Fig. 4.1 Plan of bare frame

4.2 Shear walls located at corner

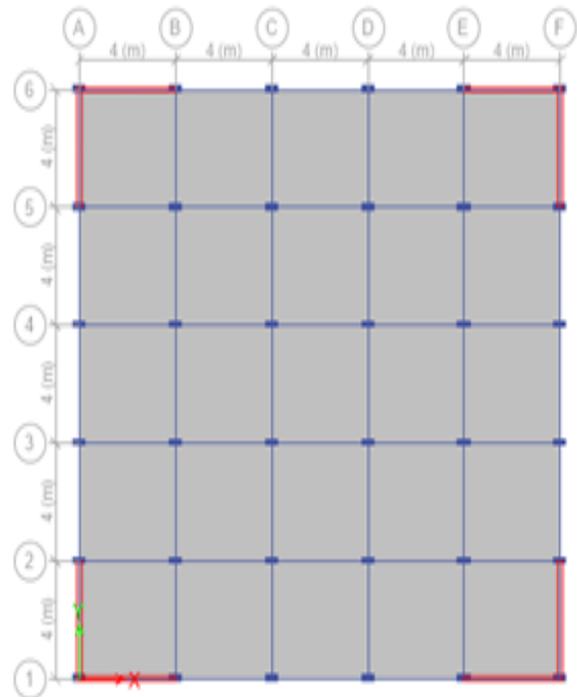


Fig. 4.2 Plan of shear wall at corner

4.3 Shear walls located at mid span

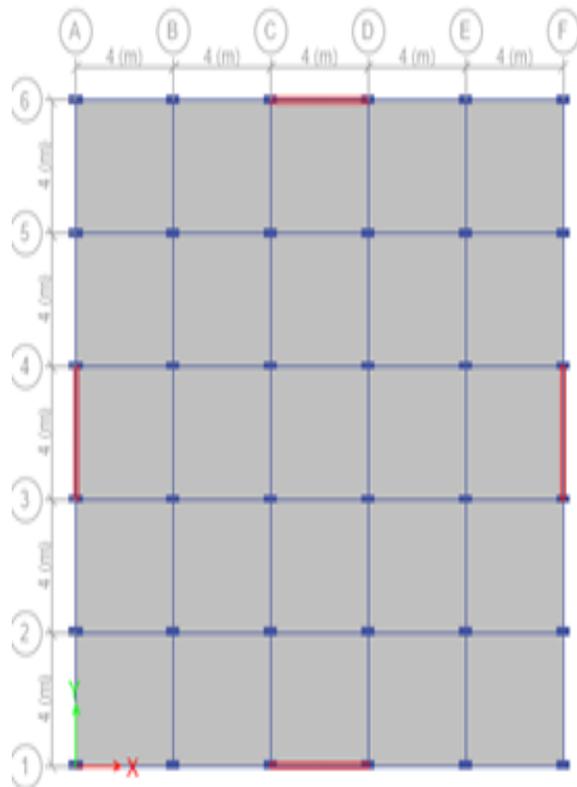


Fig. 4.3 Plan of shear wall at mid span

4.4 Shear walls located at 2nd grid corner

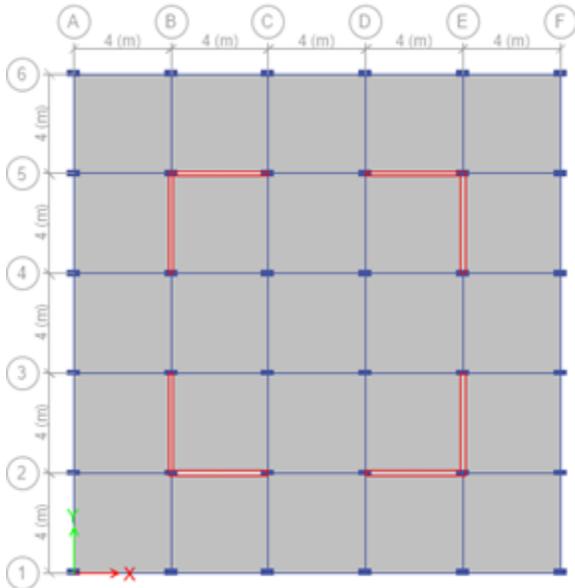


Fig. 4.4 Plan of shear wall at corner of 2nd grid

4.5 Shear walls located at 2nd grid mid span

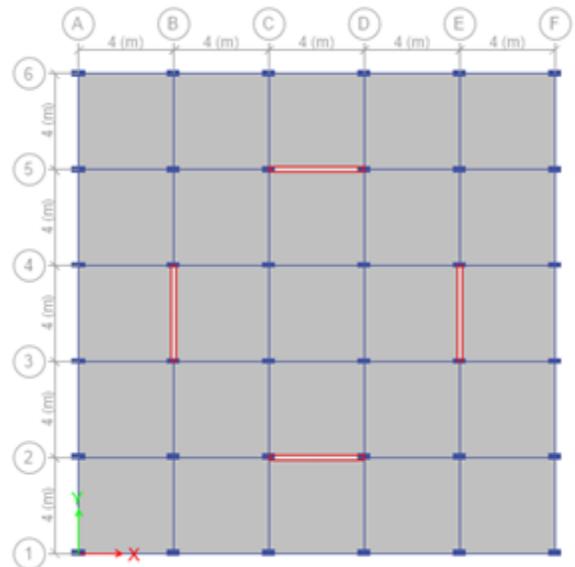


Fig. 4.5 Plan of shear wall at mid span of 2nd grid

5. RESULTS AND DISCUSSIONS

In this present study the behaviour of each model is captured and results are tabulated in form of optimum location of shear wall, lateral displacement, storey drift, base shear, storey shear, and time period equivalent static analysis. The performance of all the models are observed and compare with the suitable model.

5.1 Maximum Lateral Storey Displacement

To study the response of lateral load effect on structure we used 15 storey RC building with shear wall with different in different locations of structure in a seismic zone III. The maximum displacement occurs at each storey with respect to its base is mentioned in following tables are obtained from equivalent static method along both X and Y direction. The displacement values are plotted in graph for better comparison.

5.1.1 Maximum Lateral Storey Displacement in 15 Storeys of Zone III

Table 5.1 Lateral Displacement in X direction

Storey	Bare frame	Shear wall at Corner	Shear wall at midspan	Shear wall at Corner of 2 nd grid	Shear wall at mid span of 2 nd grid
15	27.5	22	24.1	19.9	24.1
14	26.7	20.5	22.9	18.6	22.9
13	25.7	18.9	21.5	17.3	21.5
12	24.4	17.2	20	15.8	20
11	22.9	15.5	18.3	14.3	18.3
10	21.1	13.7	16.6	12.7	16.5
9	19.2	11.9	14.7	11.1	14.6
8	17.1	10.1	12.7	9.5	12.6
7	15	8.3	10.7	7.8	10.6
6	12.8	6.6	8.6	6.2	8.6
5	10.6	5	6.6	4.7	6.6
4	8.3	3.5	4.7	3.3	4.7
3	6.1	2.2	3	2.1	3
2	3.9	1.1	1.6	1.1	1.6
1	1.8	0.4	0.5	0.4	0.5
0	0	0	0	0	0

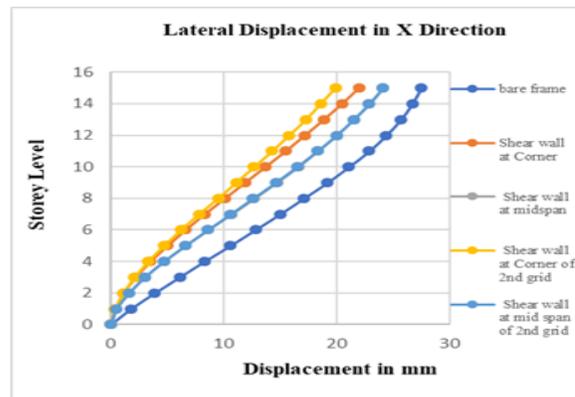


Fig. 5.1 Lateral Displacement in X Direction

Table 5.2 Lateral Displacement in Y direction

Storey	Bare frame	Shear wall at Corner	Shear wall at midspan	Shear wall at Corner of 2 nd grid	Shear wall at mid span of 2 nd grid
15	43.5	26.4	30.6	21.4	30
14	40.6	24.4	28.8	19.9	28.2
13	37.7	22.3	26.8	18.4	26.3
12	34.8	20.2	24.8	16.8	24.3
11	31.9	18	22.5	15.2	22.1
10	29	15.8	20.2	13.5	19.8
9	26.1	13.6	17.7	11.7	17.4
8	23.2	11.4	15.2	10	15
7	20.3	9.3	12.6	8.2	12.4
6	17.4	7.3	10.1	6.5	10
5	14.5	5.4	7.7	4.9	7.6
4	11.6	3.8	5.4	3.4	5.3
3	8.7	2.3	3.4	2.1	3.3
2	5.8	1.2	1.7	1.1	1.7
1	2.9	0.4	0.5	0.4	0.5
0	0	0	0	0	0

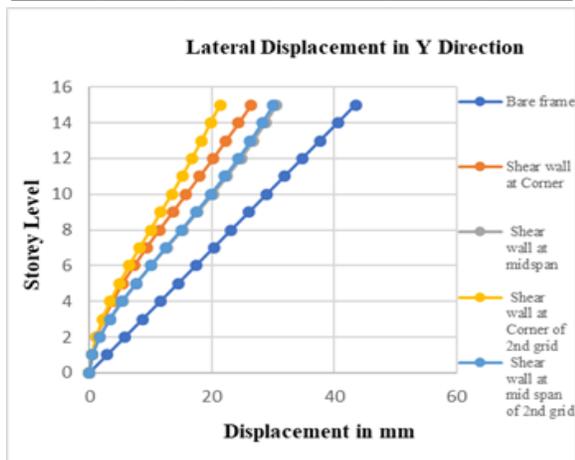


Fig. 5.2 Lateral Displacement in Y Direction

5.1.2 Observation and Discussion on Lateral Displacement

By studying table 5.1 to table 5.2 and comparing their values in fig 5.1 to fig 5.2, it is observed that displacement values are higher in Bare frame when compare to other model, the displacements seen in Bare frame are comparatively more than models with shear wall. The displacement Values in the structure is goes on increases from lower storey to the higher storey in the structure.

It is observed that the displacement value in Y-Direction is more when compare to X-Direction.

5.2 Storey Drift

“It is defined as the ratio of displacement of two consecutive floor to height of that floor.”

The maximum permissible Drift for an RC structure as IS 1893 – 2002 is 0.004 times of the storey height. The maximum storey drift values for all building models along X and Y direction shown below.

5.2.1 Storey Drift in 15 Storeys of Zone III

Table 5.3 Storey Drift in X Direction

Storey	Bare frame	Shear wall at Corner	Shear wall at midspan	Shear wall at Corner of 2 nd grid	Shear wall at mid span of 2 nd grid
15	0.000241	0.000513	0.000416	0.000431	0.000422
14	0.000342	0.000534	0.000457	0.000458	0.000462
13	0.000436	0.000554	0.000502	0.000482	0.000506
12	0.000517	0.000575	0.000549	0.000506	0.000552
11	0.000584	0.000592	0.000593	0.000526	0.000595
10	0.000638	0.000602	0.000631	0.000541	0.000632
9	0.00068	0.000604	0.000659	0.000547	0.000659
8	0.000711	0.000596	0.000676	0.000545	0.000674
7	0.000732	0.000577	0.000678	0.000532	0.000676
6	0.000744	0.000545	0.000664	0.000506	0.000662
5	0.000748	0.000498	0.00063	0.000467	0.000627
4	0.000744	0.000435	0.000572	0.000411	0.000569
3	0.000734	0.000353	0.000483	0.000337	0.000481
2	0.000706	0.000249	0.000353	0.00024	0.000352
1	0.000594	0.000123	0.000174	0.00012	0.000177
0	0	0	0	0	0

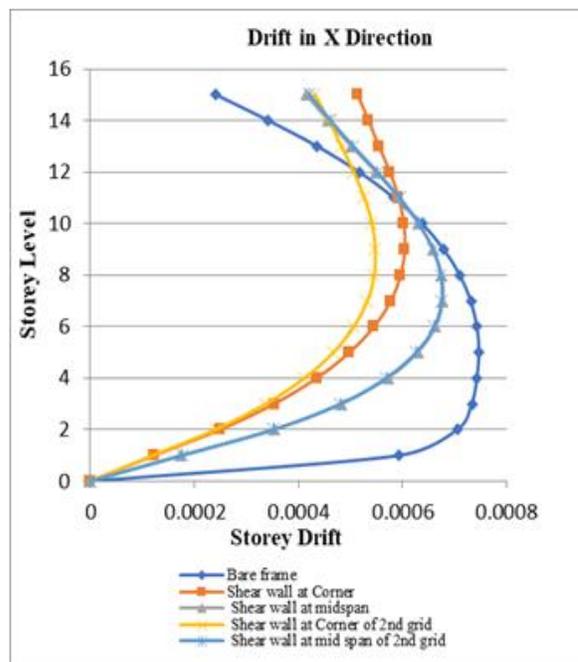


Fig. 5.3 Storey Drift in X Direction

Table 5.4 Storey Drift in Y Direction

Storey	Bare frame	Shear wall at Corner	Shear wall at midspan	Shear wall at Corner of 2 nd grid	Shear wall at mid span of 2 nd grid
15	0.000276	0.000679	0.000617	0.000482	0.000593
14	0.000438	0.000693	0.000651	0.000505	0.000629
13	0.000581	0.000709	0.000695	0.000528	0.000673
12	0.000703	0.000723	0.000741	0.000551	0.00072
11	0.000805	0.000732	0.000784	0.00057	0.000764
10	0.000888	0.000732	0.000819	0.000583	0.0008
9	0.000953	0.000723	0.000843	0.000588	0.000824
8	0.001003	0.000703	0.000852	0.000582	0.000834
7	0.001039	0.000671	0.000843	0.000566	0.000826
6	0.001062	0.000624	0.000813	0.000536	0.000798
5	0.001074	0.000562	0.000758	0.000491	0.000746
4	0.001078	0.000482	0.000674	0.00043	0.000664
3	0.001073	0.000384	0.000554	0.00035	0.000548
2	0.00106	0.000264	0.000392	0.000248	0.000389
1	0.000965	0.000123	0.000178	0.00012	0.00018
0	0	0	0	0	0

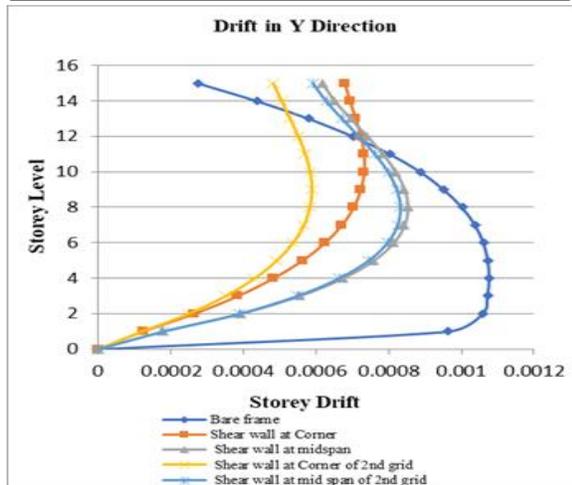


Fig. 5.4 Storey Drift in Y Direction

5.2.2 Observation and Discussion on Storey Drift

By studying Table 5.3 to Table 5.4 and comparing in Fig 5.3 to Fig 5.4 it can be observed that drift values are different in every model. In 15 storeys building drift values in Bare frame model goes on increases from base up to storeys 4 and gradually reduces on to higher stories, the drift values in model with shear wall at corner goes on increases from base up to storey 11 and gradually reduces on to higher stories, the drift values in model with shear wall at mid span goes on increases from base up to storey 8 and gradually reduces on to higher stories, the drift values in model with shear wall at corner of 2nd grid goes

on increases from base up to storey 9 and gradually reduces on to higher stories, the drift values in model with shear wall at mid span of 2nd grid goes on increases from base up to storey 8 and gradually reduces on to higher stories.

Then it observed that however provision of shear wall slightly decreases in storey drift and storey drift in X direction is lesser when compare to Y direction.

5.3 Base Shear

“Base Shear is an estimate of the maximum expected lateral force that will occur due to seismic ground motion at the base of the structure.”

The base shear all values are obtained from ETABS 2015 and listed below.

5.3.1 Base Shear of 15 Storeys in Zone III

Table 5.5 Base Shear in X and Y Direction

Models	F _x (KN)	F _y (KN)
Bare frame	852.1345	586.791
Shear wall at corner	1484.2903	1272.85
Shear wall at midspan	1175.6313	957.028
Shear wall at corner of 2 nd grid	1601.8012	1496.16
Shear wall at mid span of 2 nd grid	1177.8738	975.348

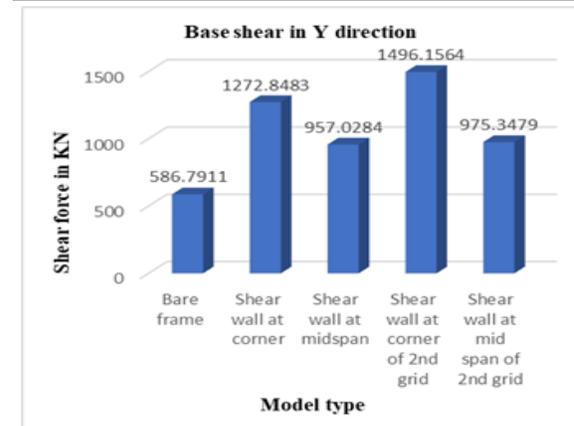
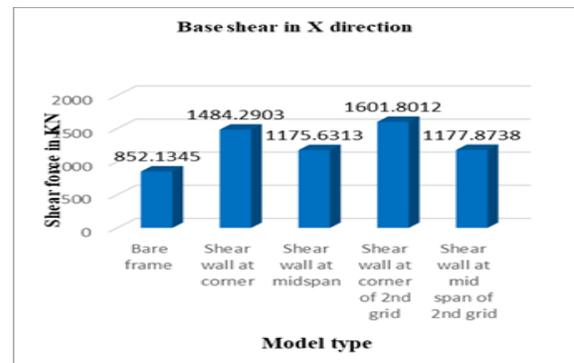


Fig. 5.6 Base Shear in Y Direction

5.3.2 Observation and Discussion on Base Shear

By studying Table 5.5 and comparing Fig 5.5 to Fig 5.6, it can be observed that provision of shear wall increases the base shear. The maximum base shear value is found out for the shear wall located in corner of 2nd grid model. The base shear values are maximum in X direction compared with Y direction.

5.4 Storey Shear

“Storey Shear is an estimate of the maximum expected lateral force that will occur due to seismic ground motion at the base of each storey of the structure.”

The storey shear for each model is obtained from ETABS 2015 and values are plotted against the storey level.

5.4.1 Storey Shear of 15 Storeys in Zone III

Table 5.6 Storey Shear in X Direction

Storey	Bare frame	Shear wall at Corner	Shear wall at midspan	Shear wall at Corner of 2 nd grid	Shear wall at mid span of 2 nd grid
15	145.2707	243.594	196.4274	254.4722	193.8194
14	281.7686	483.1768	385.5151	514.6461	383.8437
13	399.4631	689.7558	548.5549	738.9797	547.6912
12	499.7472	865.7757	687.4765	930.1278	687.3009
11	584.0137	1013.6814	804.2092	1090.7454	804.6118
10	653.6555	1135.9175	900.6824	1223.4871	901.563
9	710.0653	1234.9287	978.8258	1331.008	980.0934
8	754.636	1313.1598	1040.5687	1415.9627	1042.1422
7	788.7605	1373.0555	1087.8406	1481.0062	1089.6482
6	813.8315	1417.0605	1122.571	1528.7932	1124.5506
5	831.2419	1447.6195	1146.6893	1561.9786	1148.7884
4	842.3846	1467.1773	1162.1251	1583.2173	1164.3006
3	848.6524	1478.1785	1170.8077	1595.1641	1173.0262
2	851.4381	1483.0679	1174.6666	1600.4738	1176.9043
1	852.1345	1484.2903	1175.6313	1601.8012	1177.8738
0	0	0	0	0	0

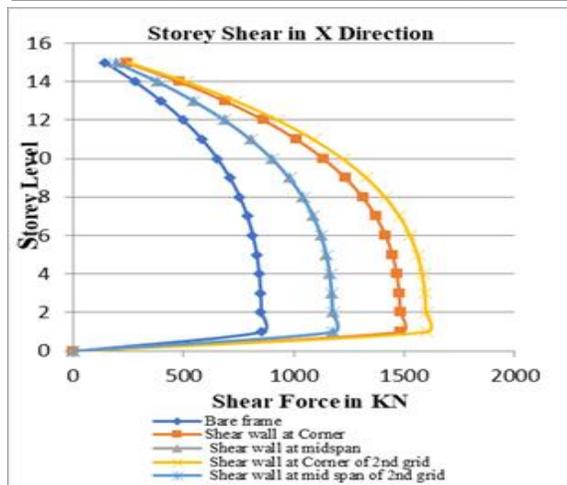


Fig. 5.7 Storey Shear in X Direction

Table 5.7 Storey Shear in Y Direction

Storey	Bare frame	Shear wall at Corner	Shear wall at midspan	Shear wall at Corner of 2 nd grid	Shear wall at mid span of 2 nd grid
15	100.0354	208.8933	159.9027	237.6888	160.4938
14	194.0296	414.3467	313.8304	480.7032	317.8449
13	275.0756	591.4978	446.5538	690.2412	453.5201
12	344.1326	742.4431	559.6436	868.7824	569.1251
11	402.1596	869.2792	654.6704	1018.8066	666.2653
10	450.1159	974.1023	733.2049	1142.7936	746.5465
9	488.9604	1059.0091	796.8179	1243.223	811.5743
8	519.6524	1126.0959	847.08	1322.5747	862.9543
7	543.151	1177.4593	885.562	1383.3283	902.292
6	560.4152	1215.1956	913.8344	1427.9636	931.1933
5	572.4043	1241.4014	933.468	1458.9603	951.2636
4	580.0773	1258.1731	946.0336	1478.7982	964.1086
3	584.3933	1267.6072	953.1017	1489.9571	971.3339
2	586.3116	1271.8001	956.2431	1494.9165	974.5451
1	586.7911	1272.8483	957.0284	1496.1564	975.3479
0	0	0	0	0	0

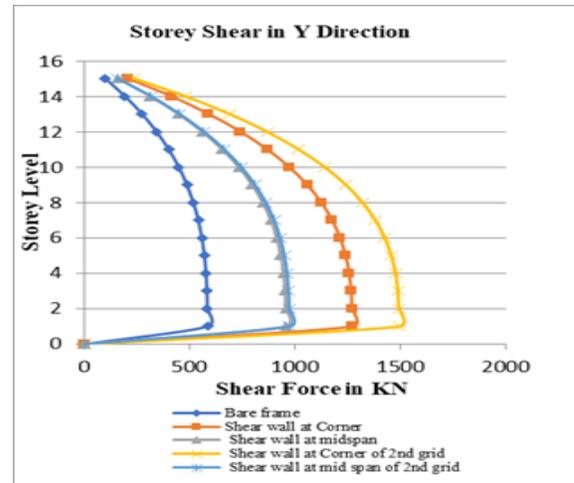


Fig. 5.8 Storey Shear in Y Direction

5.4.1 Observation and Discussion on Storey Shear

By Studying Table 5.6 to Table 5.7 and comparing in Fig 5.7 to Fig 5.8 we can conclude that storey shear is highest at the bottom stories of the structure. And it goes on decreasing as the storey height increases. This is because of bottom storey levels are directly in contact with the ground and feels the maximum effect of lateral forces.

5.5 Modal Time Period

Modal Time period of a structure is the natural time period of the undamped free vibration. The time

period of normal single storey to 20 storey buildings are usually in the range 0.05-2.00 sec.

Time period required for each mode shape is obtained from ETABS and graph is plotted for Mode Shape vs. Time Period.

Modal Time Period of 15 Storeys in Zone III

Table 5.8 Modal Time Period

Modes	Bare frame	Shear wall at Corner	Shear wall at midspan	Shear wall at Corner of 2 nd grid	Shear wall at mid span of 2 nd grid
1	2.348	1.245	1.548	1.035	1.517
2	1.673	1.068	1.26	0.967	1.256
3	1.617	0.75	1.011	0.831	1.24
4	0.78	0.29	0.42	0.264	0.414
5	0.554	0.269	0.36	0.252	0.362
6	0.53	0.166	0.272	0.219	0.358
7	0.459	0.129	0.191	0.119	0.19
8	0.327	0.123	0.173	0.116	0.178
9	0.325	0.081	0.123	0.102	0.173
10	0.304	0.078	0.111	0.072	0.112
11	0.254	0.072	0.104	0.07	0.108
12	0.229	0.06	0.075	0.064	0.104

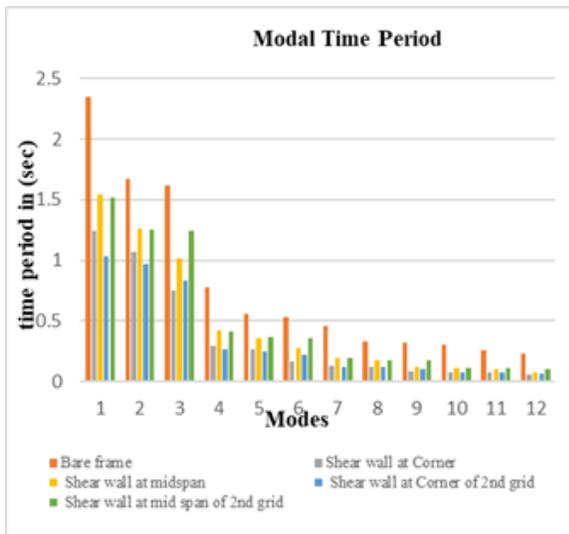


Fig. 5.9 Modal Time Period

5.6.3 Observation and Discussion on Modal Time Period

By studying Table 5.8 and comparing in Fig 5.9 it is observed that modal time period is more in Bare frame compare to models with shear wall. Due to the Provision of shear wall the time period goes on decreases. The time period of shear wall at corner of 2nd grid is found less among all models.

6. CONCLUSION AND SCOPE FOR FUTURE STUDIES

6.1 Conclusion

- [1] From the comparison of the results it is found that the optimum location of shear wall is found in the corners of the building.
- [2] It can be concluded that, provision of Shear wall in the structure reduces the lateral storey displacements in the building compared to Bare frame.
- [3] It can be concluded that, the storey drift of the building with the Shear walls is found within the permissible limits.
- [4] It can be concluded that, the storey drift is more in the middle storeys compared with the base and gradually reduces up to the top of the building.
- [5] It can be concluded that, the storey shear of the structure varies with the provision of Shear walls in structure.
- [6] It can be concluded that, the Storey Shear is maximum in the bottom storeys because it is fixed at the bottom and hence gradually decreases at the above storeys.
- [7] It can be concluded that, the Base shear of the structure with Shear walls is found to be more compared to Bare frame.
- [8] It can be concluded that, the provision of Shear wall decreases the time period comparatively with Bare frame in comparison.
- [9] It can be concluded that the providing Shear wall increases the seismic performance of the structures.
- [10] The location of shear wall affects various structural parameters like mass, stiffness matrices.

6.2 Scope for Future Work

The work presented in this dissertation may use as basis for future works suggested below,

- [1] A high-rise building of higher stories can be studied for different seismic zones in India.
- [2] The present work is based on the Equivalent static method analysis and the dynamic analysis like Time History Method, Response Spectrum Method can be implemented to check the obtained results.
- [3] In the present study, the shear wall thickness is kept uniform throughout the analysis and the

results can be obtained by varying the thickness of the shear wall.

- [4] In this study, the Rectangular Shape Shear wall is used throughout the analysis and the results can be obtained by using different shapes of shear walls like C-Type, L-Type, T-Type etc.
- [5] In this study, the analysis is carried out on flat ground and hence the results can be verified using sloping grounds.
- [6] In the present study, the ordinary moment resisting building is considered and the results can be verified using Special moment resisting building.
- [7] Experimental work can be done to verify analytically obtained results.
- [8] Design estimation is necessary to check the cost effectiveness.
- [9] In present, only, analysis is done for Earthquake Loads. The same may be extended to Wind Load analysis as per BIS code 875(Part-III):1987.
- [10] Performance of building taking different heights of building with shear wall.

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