3

Comparison of Tall Building G+30 Based on Shear Wall System and Dual system

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Abstract

The construction of high-rise buildings has been significantly affected by the growth in urban population and the scarcity of available land. With an increase in building height, lateral loads significantly impact the design. When designing tall buildings, safety and minimal damage should come first so that they can withstand lateral stresses. The structure should have enough lateral strength, lateral stiffness, and ductility to achieve these requirements. Designers may decide to focus on shear wall systems or moment-resisting frame systems among the many structural systems. Examining and monitoring how these systems behave when there is a seismic influence is crucial. In the present study, seismic response of structural system at different seismic zones was analyzed. The seismic reaction was quantified in terms of time, the largest story displacement, largest story drift, required amount of steel and concrete. Regardless of the building height and seismic zones, results showed that a shear wall system was more effective in terms of cost and lateral load resistance. The goal of the present study was to compare the seismic behavior of two bare frame systems and assess the working of shear walls work with moment-resisting frames. Shear walls and bare frames are combined in the first model, while shear walls are absent in the second model and are analyzed statically and dynamically using ETABS 2020 software.

Keywords

Tall buildings, shear wall system, dual system, seismic forces, ETABS

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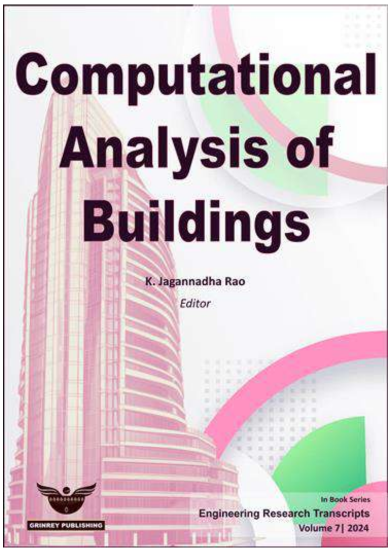


1. Introduction

A dual structural system is one in which shear walls and a moment-resisting frame that have been meticulously constructed give resistance to lateral loads while supporting gravity loads on an almost entirely complete frame. Both shear walls and frames assist in withstanding lateral stresses caused by earthquakes or wind, and the amount of force that each can endure depends on its stiffness, ductility, and capacity for forming plastic hinges in its sections. The moment-resisting frame may be made of steel or concrete. Systems must be built to withstand the entire lateral load according to their respective rigidities and the Dual system must be able to sustain at least 25% of the base shear. Shear walls and frames both aid in the dual system's ability to withstand lateral loads. The beams and columns that make up the frame are connected to one another via stiff connections. While the shear walls deflect in a cantilever mode, the frames bend in a shear mode. Due to the various deflection characteristics of frames and walls, near the top of the building, the frames will try to pull the shear walls while trying to push the walls towards the bottom. As a result, the frames will be able to support lateral loads in the top part of the building, increasing the cross-sectional area of the columns. Therefore, the stiffness of the frames where fixed support is supplied, whose rigidity equals the rigidity of the frames in the top, determines how the lateral loads are distributed in the top. The reaction of these supports represents the share of the frames, and the remaining portion represents the share of the top. The walls can sustain earthquake loads since they are fastened at the bottom and pinned or supported by the frames at the top. The positions of the shear walls are designed and constructed so that the earthquake force is evenly distributed throughout the building's plan area, reducing the overall need for concrete and steel reinforcement [1]. Over its height, a building's concrete quality varies. Lowering the reinforcing and structural element sizes in these storeys by using higher-grade concrete at the bottom story. The concrete grade is lowered to in the top levels where there is significantly less of a need for reinforcing. The current goal was to assess the stability differences between the dual structure and the common moment-resistant frame structure.

2. Methodology

2.1 General Description

In the present study, the height of the basement was 3.725m at non-tower and 4.725m at tower area. Height of stilt floor was 2.95m and typical story was 3.15m. The floor plate of building is symmetrical and regular shape. The buildings was analyzed as ductile shear wall and dual system as per IS: 1893(Part1)-2016 [2] & IS:13920-2016 [3]. For buildings greater than 50m, codal provisions as per IS 16700-2017 [4] were applicable. The structural system shall have RCC structural walls and suspended slab over beams. The systems was designed to resist the total design force in proportion to their lateral stiffness considering the interaction at all floor levels. Since the building was located in seismic zone IV, the structure was analyzed for dynamic earthquake loads. Floor slabs shall be checked as per Cl 7.6.4 of IS1893 (Part1)-2016 [2] for diaphragms action in horizontal direction accordingly was defined as Semi-Rigid. Since the FAR was greater than 2.

2.2 Material, Grade, Cover and Preliminary Section Sizes

The size of the different members for column/shear wall, beams, slab has been given in Table 1 respectively.

If required, slabs may be locally thickened for larger panels. Secondary beams will be used to divide slab panels and reduce thickness. Minimum thickness for slab subjected to fire tender load is assumed to be

200mm However, the strength of bars for secondary elements shall be taken as 415N/mm^2. Coupler shall be used in case of higher diameter bars (above 20 dia bars) as per amendment 1- IS: 16700-2017 [4].

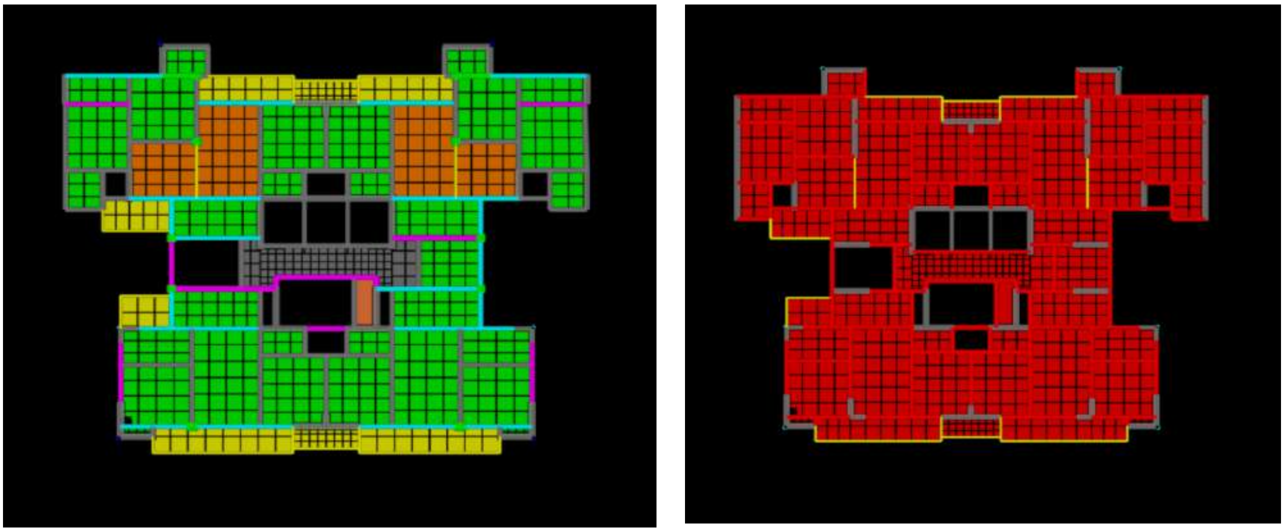
Fig. 1. 3D ETABS Model

Table 1. Size of various members

Members	**Sizes/Thickness**
Shear Walls	240-400 mm thick
Staircase Shear Walls	300-400 mm thick
Column 1	450 × 450 mm
Column 2	450 × 650 mm
Lift Core Shear Walls	240-300 mm thick
Main beams External	240 × 500-600
Main beams Internal	240 × 500-600
Secondary beams	240 × 500
Stilt Level	150 mm
Non-Tower area	200 mm
Typical Level	125/225 mm
Terrace	125/225 mm

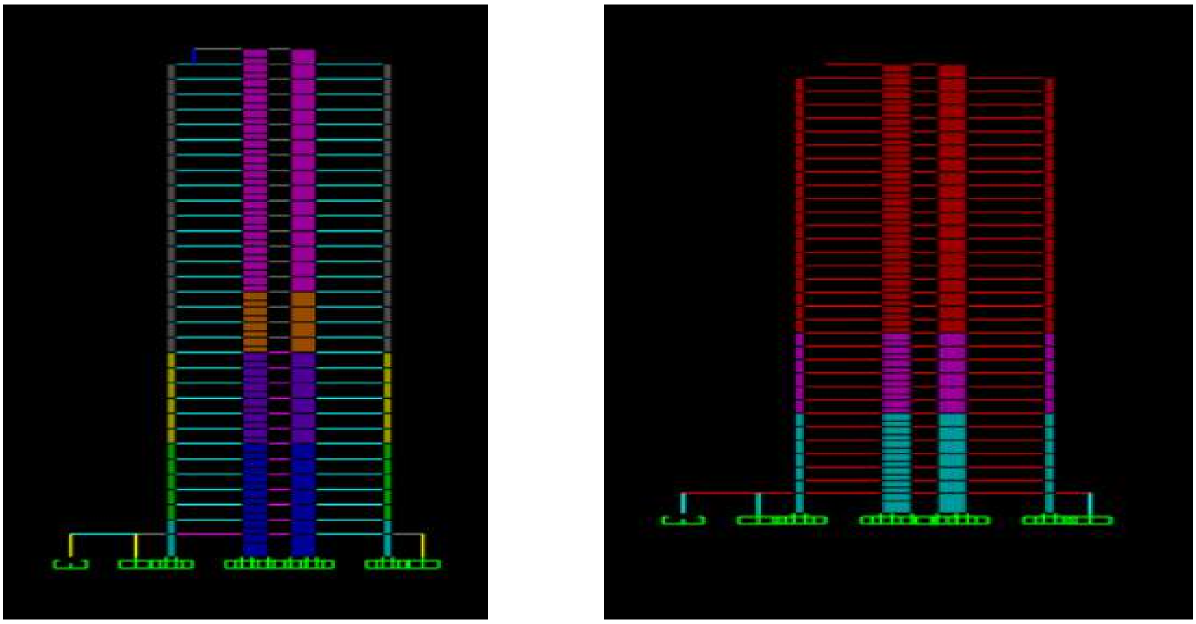
2.3 Basic Loadings

The self-weight of beams, columns and slab. The superimposed loads shall be calculated in accordance with IS:875(Part-2)-1987 [5] based on occupancy classification. For multiple occupancies of use in the building shall be referred with the other appropriate comparable occupancy classification as per Table.1 of IS 875(Part-2)-1987 [5]. Also, some of the imposed loads as mentioned, are reproduced in this section. The Wind pressure was calculated in accordance with IS: 875 Part.3-2015 [6]. The Proposed building has the following factors to be considered for designs as per IS: 1893(Part1)-2016 [2]. Figure 2 (a) and (b) shows the layout plan of the slab for the shear wall system and dual system. Figure 3 (a) and (b) showed the elevation of the building for shear wall system and dual system.



(a) (b)

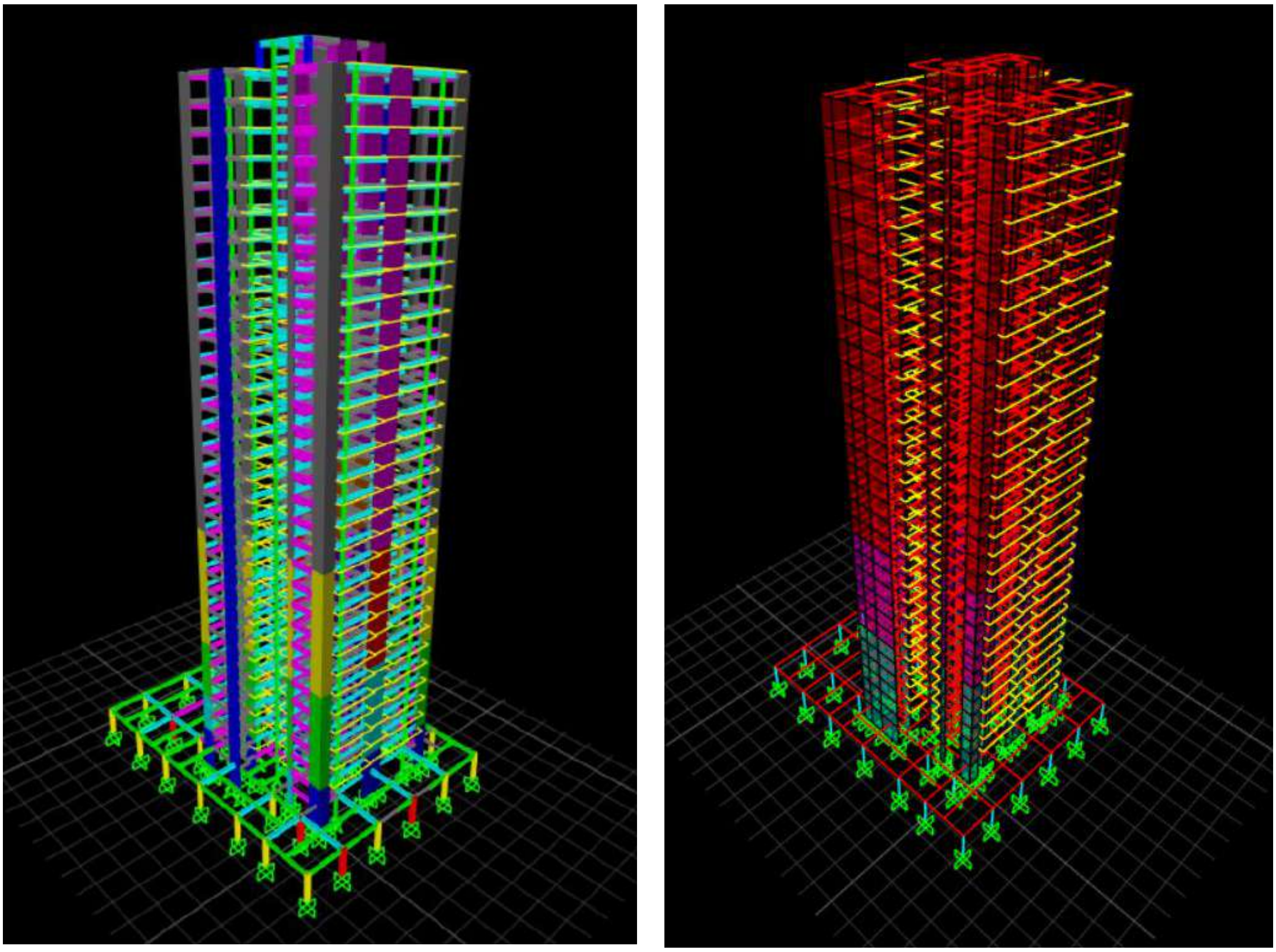
Fig. 2. Slab Layout Plan (a) Dual System; (b) Shear Wall System



(a) (b)

Fig. 3. Elevation of the building (a) Dual System; (b) Shear Wall System

The structural system has RCC structural walls and suspended slabs over beams. The systems will be designed to resist the total design force in proportion to their lateral stiffness considering the interaction at all floor levels. Since the building is located in seismic zone IV, the structure was analyzed for dynamic earthquake loads. Floor slabs was checked as per Cl 7.6.4 of IS1893 (Part1)-2016 [2] for diaphragms action in horizontal direction accordingly shall be defined as Semi-Rigid. Since this is a standardization & Cost optimization exercise, only one tower shall be modeled with basement below tower. Basement below non-tower as shown in plans shall be modelled. The retaining wall shall not be modeled.



(a) (b)

Fig. 4. 3D views (a) Dual System, (b) Shear Wall System

3. Result

The analysis of both structures was carried out using ETAB. A comparison between maximum displacement, drift and stiffness was done in X and Y directions for both Shear wall structure and dual structure. Also, deflection in both structures was analyzed. For The values for the maximum displacement, drift, and stiffness for both directions (X and Y) for shear wall system and dual system have been given in Table 2,4,6,8,10,12 and Table 3,5,7,9,11,13 respectively.

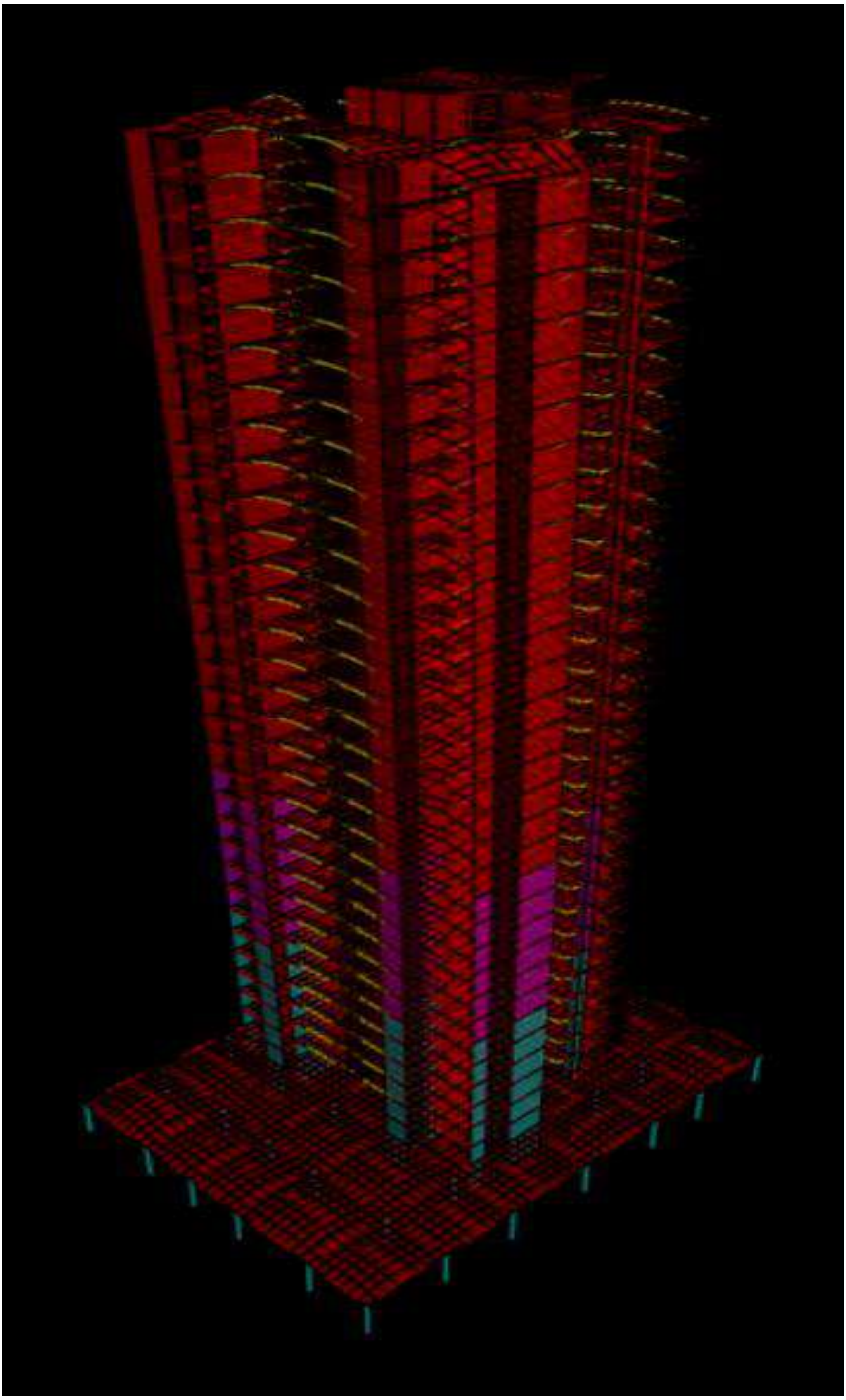


Fig. 5. Deformed Shape of Building

Table 2. Average displacement of shear wall system in X direction

Story	Output Case	Max Displacement, mm	Avg Displacement, mm	Ratio
MUMTY	DL+EQXP	212.5	194.844	1.091
TERRACE	DL+EQXP	246.126	195.644	1.258
30F	DL+EQXP	238.772	190.268	1.255
29F	DL+EQXP	231.159	184.622	1.252
28F	DL+EQXP	223.361	178.799	1.249
27F	DL+EQXP	215.353	172.786	1.246
26F	DL+EQXP	207.122	166.575	1.243
25F	DL+EQXP	198.665	160.16	1.24
24F	DL+EQXP	189.984	153.533	1.237
23F	DL+EQXP	181.089	146.701	1.234
22F	DL+EQXP	171.994	139.68	1.231
21F	DL+EQXP	162.723	132.487	1.228
20F	DL+EQXP	153.301	125.146	1.225
19F	DL+EQXP	143.755	117.678	1.222
18F	DL+EQXP	134.118	110.109	1.218
17F	DL+EQXP	124.425	102.467	1.214
16F	DL+EQXP	114.715	94.785	1.21
15F	DL+EQXP	105.032	87.098	1.206
14F	DL+EQXP	95.424	79.441	1.201
13F	DL+EQXP	85.942	71.853	1.196
12F	DL+EQXP	76.64	64.377	1.19
11F	DL+EQXP	67.573	57.054	1.184
10F	DL+EQXP	58.788	49.916	1.178
9F	DL+EQXP	50.34	43.006	1.171
8F	DL+EQXP	42.293	36.374	1.163
7F	DL+EQXP	34.711	30.073	1.154
6F	DL+EQXP	27.665	24.165	1.145
5F	DL+EQXP	21.212	18.701	1.134
4F	DL+EQXP	15.414	13.73	1.123
3F	DL+EQXP	10.362	9.337	1.11
2F	DL+EQXP	6.335	5.707	1.11
2F	DL+EQXP	1.656	0.628	2.638
1F	DL+EQXP	3.314	2.935	1.129
1F	DL+EQXP	0.963	0.392	2.458
STILT	DL+EQXP	1.523	1.177	1.294
STILT	DL+EQXP	0.45	0.143	3.145

Table 3. Average displacement of dual structure system in X direction

Story	Output Case	Max Displacement, mm	Avg Displacement, mm	Ratio
MUMTY	DL+EQXP	246.486	237.711	1.037
TERRACE	DL+EQXP	259.093	234.672	1.104
30F	DL+EQXP	251.587	228.16	1.103
29F	DL+EQXP	243.786	221.326	1.101
28F	DL+EQXP	235.766	214.273	1.1
27F	DL+EQXP	227.507	206.992	1.099
26F	DL+EQXP	218.991	199.472	1.098
25F	DL+EQXP	210.212	191.701	1.097
24F	DL+EQXP	201.173	183.679	1.095
23F	DL+EQXP	191.884	175.413	1.094
22F	DL+EQXP	182.363	166.919	1.093
21F	DL+EQXP	172.631	158.216	1.091
20F	DL+EQXP	162.715	149.329	1.09
19F	DL+EQXP	152.645	140.286	1.088
18F	DL+EQXP	142.456	131.119	1.086
17F	DL+EQXP	132.188	121.869	1.085
16F	DL+EQXP	121.886	112.577	1.083
15F	DL+EQXP	111.602	103.289	1.08
14F	DL+EQXP	101.389	94.049	1.078
13F	DL+EQXP	91.302	84.904	1.075
12F	DL+EQXP	81.401	75.908	1.072
11F	DL+EQXP	71.744	67.11	1.069
10F	DL+EQXP	62.384	58.553	1.065
9F	DL+EQXP	53.383	50.291	1.061
8F	DL+EQXP	44.808	42.385	1.057
7F	DL+EQXP	36.732	34.9	1.052
6F	DL+EQXP	29.229	27.908	1.047
5F	DL+EQXP	22.364	21.473	1.041
4F	DL+EQXP	16.253	15.684	1.036
3F	DL+EQXP	11.152	10.709	1.041
2F	DL+EQXP	6.975	6.57	1.062
1F	DL+EQXP	3.699	3.236	1.143
1F	DL+EQXP	0.699	0.358	1.953
STILT	DL+EQXP	1.647	1.308	1.259

Table 4. Displacement of shear wall system in Y direction

Story Max Over Avg Displacements Y DIRECTION (SHEAR WALL)				
Story	**Output Case**	**Max Displacement, mm**	**Avg Displacement, mm**	**Ratio**
MUMTY	DL+EQYP	350.057	316.124	1.107
TERRACE	DL+EQYP	398.933	322.133	1.238
30F	DL+EQYP	385.466	311.716	1.237
29F	DL+EQYP	371.74	301.093	1.235
28F	DL+EQYP	357.901	290.363	1.233
27F	DL+EQYP	343.883	279.463	1.231
26F	DL+EQYP	329.639	268.345	1.228
25F	DL+EQYP	315.138	256.978	1.226
24F	DL+EQYP	300.367	245.35	1.224
23F	DL+EQYP	285.331	233.463	1.222
22F	DL+EQYP	270.046	221.331	1.22
21F	DL+EQYP	254.542	208.978	1.218
20F	DL+EQYP	238.857	196.434	1.216
19F	DL+EQYP	223.039	183.738	1.214
18F	DL+EQYP	207.144	170.936	1.212
17F	DL+EQYP	191.233	158.08	1.21
16F	DL+EQYP	175.373	145.226	1.208
15F	DL+EQYP	159.64	132.436	1.205
14F	DL+EQYP	144.112	119.777	1.203
13F	DL+EQYP	128.875	107.319	1.201
12F	DL+EQYP	114.019	95.136	1.198
11F	DL+EQYP	99.633	83.303	1.196
10F	DL+EQYP	85.789	71.88	1.193
9F	DL+EQYP	72.589	60.954	1.191
8F	DL+EQYP	60.143	50.618	1.188
7F	DL+EQYP	48.573	40.972	1.186
6F	DL+EQYP	38.006	32.131	1.183
5F	DL+EQYP	28.561	24.195	1.18
4F	DL+EQYP	20.436	17.303	1.181
3F	DL+EQYP	13.582	11.501	1.181
2F	DL+EQYP	8.089	6.861	1.179
1F	DL+EQYP	4.098	3.456	1.186
STILT	DL+EQYP	0.498	0.174	2.856
STILT	DL+EQYP	1.834	1.417	1.294
STILT	DL+EQXP	1.523	1.177	1.294
STILT	DL+EQXP	0.45	0.143	3.145

Table 5. Displacement of dual system in Y direction

Story Max Over Avg Displacements Y DIRECTION (DUAL STRUCTURE)				
Story	**Output Case**	**Max Displacement, mm**	**Avg Displacement, mm**	**Ratio**
MUMTY	DL+EQYP	393.47	344.48	1.142
TERRACE	DL+EQYP	467.733	356.385	1.312
30F	DL+EQYP	452.005	345.129	1.31
29F	DL+EQYP	435.959	333.639	1.307
28F	DL+EQYP	419.757	322.008	1.304
27F	DL+EQYP	403.321	310.161	1.3
26F	DL+EQYP	386.597	298.043	1.297
25F	DL+EQYP	369.556	285.623	1.294
24F	DL+EQYP	352.187	272.888	1.291
23F	DL+EQYP	334.499	259.839	1.287
22F	DL+EQYP	316.516	246.493	1.284
21F	DL+EQYP	298.273	232.876	1.281
20F	DL+EQYP	279.818	219.024	1.278
19F	DL+EQYP	261.208	204.981	1.274
18F	DL+EQYP	242.508	190.797	1.271
17F	DL+EQYP	223.791	176.53	1.268
16F	DL+EQYP	205.139	162.244	1.264
15F	DL+EQYP	186.639	148.011	1.261
14F	DL+EQYP	168.386	133.903	1.258
13F	DL+EQYP	150.481	120.003	1.254
12F	DL+EQYP	133.032	106.394	1.25
11F	DL+EQYP	116.146	93.166	1.247
10F	DL+EQYP	99.908	80.387	1.243
9F	DL+EQYP	84.441	68.158	1.239
8F	DL+EQYP	69.876	56.586	1.235
7F	DL+EQYP	56.354	45.787	1.231
6F	DL+EQYP	44.027	35.892	1.227
5F	DL+EQYP	33.031	27.015	1.223
4F	DL+EQYP	23.476	19.257	1.219
3F	DL+EQYP	15.586	12.804	1.217
2F	DL+EQYP	9.304	7.659	1.215
1F	DL+EQYP	4.703	3.861	1.218
STILT	DL+EQYP	0.624	0.208	3.003
STILT	DL+EQYP	2.095	1.589	1.318

Table 6. Storey stiffness of shear wall system in X direction

Story	**Output Case**	**Stiff X,** kN/m	**Soft Storey Check**
MUMTY	EQXP	0.0003429	
TERRACE	EQXP	93556.381	OK
30F	EQXP	191556.511	OK
29F	EQXP	278948.858	OK
28F	EQXP	358598.61	OK
27F	EQXP	423971.167	OK
26F	EQXP	480327.095	OK
25F	EQXP	529199.248	OK
24F	EQXP	571938.636	OK
23F	EQXP	609586.847	OK
22F	EQXP	643188.108	OK
21F	EQXP	673706.148	OK
20F	EQXP	701843.766	OK
19F	EQXP	729915.288	OK
18F	EQXP	755517.898	OK
17F	EQXP	781020.3	OK
16F	EQXP	807278.723	OK
15F	EQXP	834765.979	OK
14F	EQXP	864161.444	OK
13F	EQXP	896703.823	OK
12F	EQXP	933042.45	OK
11F	EQXP	972855.196	OK
10F	EQXP	1019034.47	OK
9F	EQXP	1073972.19	OK
8F	EQXP	1141126.51	OK
7F	EQXP	1225600.11	OK
6F	EQXP	1333593.61	OK
5F	EQXP	1473149.82	OK
4F	EQXP	1676784.34	OK
3F	EQXP	2042067.17	OK
2F	EQXP	2593847.68	OK
1F	EQXP	4068073.06	OK
STILT	EQXP	6392258.35	OK

Table 7. Storey stiffness of dual structure system in X direction

Story Stiffness X Direction (DUAL STRUCTURE)			
Story	**Output Case**	**Stiff X, kN/m**	**Soft Storey Check**
MUMTY	EQXP	0.001	
TERRACE	EQXP	74576.569	OK
30F	EQXP	148093.828	OK
29F	EQXP	213241.068	OK
28F	EQXP	273317.623	OK
27F	EQXP	322757.727	OK
26F	EQXP	365660.196	OK
25F	EQXP	402730.176	OK
24F	EQXP	435059.969	OK
23F	EQXP	463469.563	OK
22F	EQXP	488720.468	OK
21F	EQXP	511524.477	OK
20F	EQXP	532503.696	OK
19F	EQXP	553598.006	OK
18F	EQXP	572836.256	OK
17F	EQXP	592111.083	OK
16F	EQXP	612129.739	OK
15F	EQXP	633094.879	OK
14F	EQXP	655598.565	OK
13F	EQXP	680729.7	OK
12F	EQXP	708731.781	OK
11F	EQXP	739849.899	OK
10F	EQXP	776119.886	OK
9F	EQXP	819580.787	OK
8F	EQXP	873154.206	OK
7F	EQXP	941305.563	OK
6F	EQXP	1028259.01	OK
5F	EQXP	1159085.23	OK
4F	EQXP	1357713.03	OK
3F	EQXP	1674711.56	OK
2F	EQXP	2018675.24	OK
1F	EQXP	3134122.55	OK
STILT	EQXP	5151591.59	OK

Table 8. Storey stiffness of Shear wall system in Y direction

Story Stiffness Y Direction (SHEAR WALL)			
Story	**Output Case**	**Stiff Y. kN/m**	**Soft Storey Check**
MUMTY	EQYP	0.003	
TERRACE	EQYP	46302.638	OK
30F	EQYP	95818.451	OK
29F	EQYP	142330.939	OK
28F	EQYP	185960.599	OK
27F	EQYP	222587.563	OK
26F	EQYP	254558.15	OK
25F	EQYP	282347.686	OK
24F	EQYP	306595.419	OK
23F	EQYP	327941.897	OK
22F	EQYP	346984.513	OK
21F	EQYP	364273.891	OK
20F	EQYP	380307.984	OK
19F	EQYP	396448.727	OK
18F	EQYP	411390.445	OK
17F	EQYP	426461.628	OK
16F	EQYP	442179.695	OK
15F	EQYP	459015.384	OK
14F	EQYP	477448.359	OK
13F	EQYP	498155.606	OK
12F	EQYP	521716.415	OK
11F	EQYP	548302.323	OK
10F	EQYP	580127.552	OK
9F	EQYP	619287.087	OK
8F	EQYP	668942.2	OK
7F	EQYP	734191.287	OK
6F	EQYP	821679.578	OK
5F	EQYP	945079.722	OK
4F	EQYP	1139860.07	OK
3F	EQYP	1433750.22	OK
2F	EQYP	1898827.27	OK
1F	EQYP	3067381.96	OK
STILT	EQYP	4694952.84	OK

Table 9. Storey stiffness of dual structure system in Y direction

Story Stiffness Y Direction (DUAL STRUCTURE)			
Story	**Output Case**	**Stiff Y, kN/m**	**Soft Storey Check**
MUMTY	EQYP	0.002	
TERRACE	EQYP	42188.899	OK
30F	EQYP	85959.243	OK
29F	EQYP	126360.834	OK
28F	EQYP	164100.291	OK
27F	EQYP	195469.798	OK
26F	EQYP	222746.164	OK
25F	EQYP	246211.439	OK
24F	EQYP	266565.501	OK
23F	EQYP	284386.161	OK
22F	EQYP	300203.419	OK
21F	EQYP	314502.939	OK
20F	EQYP	327714.188	OK
19F	EQYP	341036.763	OK
18F	EQYP	353278.819	OK
17F	EQYP	365624.706	OK
16F	EQYP	378528.567	OK
15F	EQYP	392389.533	OK
14F	EQYP	407615.804	OK
13F	EQYP	424809.999	OK
12F	EQYP	444495.102	OK
11F	EQYP	466810.6	OK
10F	EQYP	493681.682	OK
9F	EQYP	526907.997	OK
8F	EQYP	569220.567	OK
7F	EQYP	625026.758	OK
6F	EQYP	700044.065	OK
5F	EQYP	803809.676	OK
4F	EQYP	964485.696	OK
3F	EQYP	1214130.71	OK
2F	EQYP	1637684.74	OK
1F	EQYP	2644152.54	OK
STILT	EQYP	4036724.44	OK

Table 10. Drift of shear wall system in X direction

Story	Output Case	Avg Drift, mm	Height, mm	Limit	
MUMTY	DL+EQXP	3.988	3150	12.6	OK
TERRACE	DL+EQXP	4.1	3100	12.4	OK
30F	DL+EQXP	4.327	3150	12.6	OK
29F	DL+EQXP	4.459	3150	12.6	OK
28F	DL+EQXP	4.615	3150	12.6	OK
27F	DL+EQXP	4.767	3150	12.6	OK
26F	DL+EQXP	4.921	3150	12.6	OK
25F	DL+EQXP	5.077	3150	12.6	OK
24F	DL+EQXP	5.23	3150	12.6	OK
23F	DL+EQXP	5.371	3150	12.6	OK
22F	DL+EQXP	5.496	3150	12.6	OK
21F	DL+EQXP	5.604	3150	12.6	OK
20F	DL+EQXP	5.692	3150	12.6	OK
19F	DL+EQXP	5.761	3150	12.6	OK
18F	DL+EQXP	5.808	3150	12.6	OK
17F	DL+EQXP	5.831	3150	12.6	OK
16F	DL+EQXP	5.827	3150	12.6	OK
15F	DL+EQXP	5.796	3150	12.6	OK
14F	DL+EQXP	5.738	3150	12.6	OK
13F	DL+EQXP	5.649	3150	12.6	OK
12F	DL+EQXP	5.528	3150	12.6	OK
11F	DL+EQXP	5.382	3150	12.6	OK
10F	DL+EQXP	5.205	3150	12.6	OK
9F	DL+EQXP	4.993	3150	12.6	OK
8F	DL+EQXP	4.742	3150	12.6	OK
7F	DL+EQXP	4.45	3150	12.6	OK
6F	DL+EQXP	4.117	3150	12.6	OK
5F	DL+EQXP	3.742	3150	12.6	OK
4F	DL+EQXP	3.306	3150	12.6	OK
3F	DL+EQXP	2.787	3150	12.6	OK
2F	DL+EQXP	2.17	3150	12.6	OK
1F	DL+EQXP	1.34	2950	11.8	OK
STILT	DL+EQXP	0.908	4725	18.9	OK

Table 11. Drift of dual structure system in X direction

Story	Output Case	Avg Drift, mm	Height, mm	Limit	
MUMTY	EQXP	5.556	3150	12.6	OK
TERRACE	EQXP	5.582	3100	12.4	OK
30F	EQXP	5.808	3150	12.6	OK
29F	EQXP	5.979	3150	12.6	OK
28F	EQXP	6.148	3150	12.6	OK
27F	EQXP	6.325	3150	12.6	OK
26F	EQXP	6.505	3150	12.6	OK
25F	EQXP	6.681	3150	12.6	OK
24F	EQXP	6.848	3150	12.6	OK
23F	EQXP	7.003	3150	12.6	OK
22F	EQXP	7.143	3150	12.6	OK
21F	EQXP	7.263	3150	12.6	OK
20F	EQXP	7.362	3150	12.6	OK
19F	EQXP	7.436	3150	12.6	OK
18F	EQXP	7.481	3150	12.6	OK
17F	EQXP	7.494	3150	12.6	OK
16F	EQXP	7.471	3150	12.6	OK
15F	EQXP	7.416	3150	12.6	OK
14F	EQXP	7.325	3150	12.6	OK
13F	EQXP	7.193	3150	12.6	OK
12F	EQXP	7.023	3150	12.6	OK
11F	EQXP	6.821	3150	12.6	OK
10F	EQXP	6.577	3150	12.6	OK
9F	EQXP	6.287	3150	12.6	OK
8F	EQXP	5.945	3150	12.6	OK
7F	EQXP	5.547	3150	12.6	OK
6F	EQXP	5.098	3150	12.6	OK
5F	EQXP	4.602	3150	12.6	OK
4F	EQXP	4.031	3150	12.6	OK
3F	EQXP	3.369	3150	12.6	OK
2F	EQXP	2.609	3150	12.6	OK
1F	EQXP	1.681	2950	11.8	OK
STILT	EQXP	1.024	4725	18.9	OK

Table 12. Drift of shear wall system in Y direction

Drift in Y Direction (SHEAR WALL)						
Story	**Output Case**	**Direction**	**Avg Drift, mm**	**Height, mm**	**Limit**	
MUMTY	DL+EQYP	Y	5.913	3150	12.6	OK
TERRACE	DL+EQYP	Y	7.312	3100	12.4	OK
30F	DL+EQYP	Y	7.453	3150	12.6	OK
29F	DL+EQYP	Y	7.524	3150	12.6	OK
28F	DL+EQYP	Y	7.634	3150	12.6	OK
27F	DL+EQYP	Y	7.774	3150	12.6	OK
26F	DL+EQYP	Y	7.932	3150	12.6	OK
25F	DL+EQYP	Y	8.094	3150	12.6	OK
24F	DL+EQYP	Y	8.252	3150	12.6	OK
23F	DL+EQYP	Y	8.398	3150	12.6	OK
22F	DL+EQYP	Y	8.528	3150	12.6	OK
21F	DL+EQYP	Y	8.635	3150	12.6	OK
20F	DL+EQYP	Y	8.715	3150	12.6	OK
19F	DL+EQYP	Y	8.765	3150	12.6	OK
18F	DL+EQYP	Y	8.78	3150	12.6	OK
17F	DL+EQYP	Y	8.758	3150	12.6	OK
16F	DL+EQYP	Y	8.696	3150	12.6	OK
15F	DL+EQYP	Y	8.592	3150	12.6	OK
14F	DL+EQYP	Y	8.442	3150	12.6	OK
13F	DL+EQYP	Y	8.246	3150	12.6	OK
12F	DL+EQYP	Y	8.001	3150	12.6	OK
11F	DL+EQYP	Y	7.717	3150	12.6	OK
10F	DL+EQYP	Y	7.379	3150	12.6	OK
9F	DL+EQYP	Y	6.982	3150	12.6	OK
8F	DL+EQYP	Y	6.518	3150	12.6	OK
7F	DL+EQYP	Y	5.983	3150	12.6	OK
6F	DL+EQYP	Y	5.378	3150	12.6	OK
5F	DL+EQYP	Y	4.709	3150	12.6	OK
4F	DL+EQYP	Y	3.952	3150	12.6	OK
3F	DL+EQYP	Y	3.2	3150	12.6	OK
2F	DL+EQYP	Y	2.376	3150	12.6	OK
1F	DL+EQYP	Y	1.441	2950	11.8	OK
STILT	DL+EQYP	Y	0.988	4725	18.9	OK

Table 13. Drift of dual structure system in Y direction

Story	Output Case	Direction	Avg Drift, mm	Height, mm	Limit	
MUMTY	EQYP	Y	6.889	3150	12.6	OK
TERRACE	EQYP	Y	7.79	3100	12.4	OK
30F	EQYP	Y	8.122	3150	12.6	OK
29F	EQYP	Y	8.439	3150	12.6	OK
28F	EQYP	Y	8.81	3150	12.6	OK
27F	EQYP	Y	9.204	3150	12.6	OK
26F	EQYP	Y	9.6	3150	12.6	OK
25F	EQYP	Y	9.988	3150	12.6	OK
24F	EQYP	Y	10.36	3150	12.6	OK
23F	EQYP	Y	10.709	3150	12.6	OK
22F	EQYP	Y	11.03	3150	12.6	OK
21F	EQYP	Y	11.32	3150	12.6	OK
20F	EQYP	Y	11.575	3150	12.6	OK
19F	EQYP	Y	11.789	3150	12.6	OK
18F	EQYP	Y	11.957	3150	12.6	OK
17F	EQYP	Y	12.072	3150	12.6	OK
16F	EQYP	Y	12.132	3150	12.6	OK
15F	EQYP	Y	12.136	3150	12.6	OK
14F	EQYP	Y	12.081	3150	12.6	OK
13F	EQYP	Y	11.966	3150	12.6	OK
12F	EQYP	Y	11.787	3150	12.6	OK
11F	EQYP	Y	11.544	3150	12.6	OK
10F	EQYP	Y	11.226	3150	12.6	OK
9F	EQYP	Y	10.825	3150	12.6	OK
8F	EQYP	Y	10.333	3150	12.6	OK
7F	EQYP	Y	9.736	3150	12.6	OK
6F	EQYP	Y	9.032	3150	12.6	OK
5F	EQYP	Y	8.209	3150	12.6	OK
4F	EQYP	Y	7.209	3150	12.6	OK
3F	EQYP	Y	6.039	3150	12.6	OK
2F	EQYP	Y	4.684	3150	12.6	OK
1F	EQYP	Y	3.012	2950	11.8	OK
STILT	EQYP	Y	1.828	4725	18.9	OK

4. Discussion

The average displacement, maximum displacement and ratio for shear wall system and dual structure system for both the direction have been given in Table 2 and 3, respectively. The value of maximum displacement for the shear wall system was higher value than the dual structure system.

The soft storey check was carried out by determining the storey stiffness. The storey stiffness for both shear wall system and dual structure systems in X and Y direction have been shown in Table 4 and 5, respectively. The storey stiffness was higher in X direction than Y direction and soft storey check was found to be OK in both the direction for the shear wall system. The same trend was found in case of storey stiffness in dual structure system. The value of storey stiffness was higher in case of shear wall system. The multistorey building with shear wall attracts greater base shear values in case of higher seismic zone.

The value of average drift of the shear wall system in both direction X and Y direction have been given in Table 6 and 7. From the Table 6, it was observed that the maximum value of average drift for shear wall system was 5.831 mm at 17th floor in X direction and 8.78mm at 17th floor in Y direction; but both the values are lower than the permissible limit of 12.6. Thus, the average drift for the shear wall system was OK in both the directions. Similarly, the average drift for the dual structure system 7.494 mm and 12.136 mm in X and Y direction as observed from Table 7. The average drift for the dual structure system was more as compared to the shear wall system only but the values for both systems was within the limit and was ok.

5. Conclusion

On providing shear wall up higher seismic zones, displacement decreases in multilevel buildings. It may be complete from the study that on providing shear wall up seismic areas, axial forces in vertical members will increase considerably. Shear forces in beams because of seismic excitation decreases on providing shear wall. Multilevel building with shear wall attracts giant base shear values in higher zones. Level drifts and periods decrease notably in building with shear walls. Building with shear wall performs well in terms of seismic parameters than twin system.

Reference

[1] Anil K Chopra. – Dynamics of structures: Theory and applications to Earthquake Engineering, Second edition, Pearson Education (Singapore) Pvt. ltd 2005

[2] Mahdi Hosseini and M. Farookh, Seismic Analysis of Tall Building with Reinforced Concrete Shear Wall, International Journal of Applied Engineering Research, 16 (2021) 806-822.

[3] Kamalroop Kaur and Balwinder Singh, Seismic Analysis of Symmetric and Asymmetric Structures with and without Shear wall using Etabs software, IOP Conf. Series: Earth and Environmental Science 889 (2021) 012043. https://doi.org/10.1088/1755-1315/889/1/012043

[4] Prasad J. Jadhav, Vikramsinh S. Tiware, Vivek V. Mane, Nitish A. Mohite, Mr. Siddhesh Tiwale S, Seismic Behaviour and Design of RC Shear Wall using ETABS software, International Journal for Research in Applied Science & Engineering Technology, 10 (2022) 4679-4684.

[5] Prathamesh P. Mohite, Shubham B. Sonawane, Chinmay R. Thatte, Omkar B. Udeg, Amardeep D. Bhosale, Stability of High Rise Building using Shear Wall By ETABs, International Journal of Engineering Research & Technology, 11 (2022) 458-461.

[6] IS 1893-2016, Part-1, Criteria for Earthquake Resistant Design of Structures, General Provisions and Buildings (Sixth Revision).

[7] IS 13920-2016, Ductile Design and Detailing of Reinforced Concrete Structures subjected to seismic forces-Code of Practice.

[8] IS 16700-2017, Criteria for Structural Safety of Tall Concrete Buildings.

[9] IS 875-1987, Part-2, Indian standard code of practice for design loads (other than earthquake) for buildings and structures-part 1, Imposed loads.

[10] IS 875-1987, Part-3, Indian standard code of practice for design loads (other than earthquake) for buildings and structures-part 1, Wind loads.