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Comparison of Seismic Behaviour of Multi Storey Reinforced concrete Structure with Dual System

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Abstract— In general, the structure can be prone to serious harm in elevated seismic regions. Along with the structure of the gravity load, the lateral load must be able to create elevated stresses. Now a days the shear wall in R.C structure with the steel structure and steel bracing system is most common for resisting lateral loads due to earthquake, wind, blast, etc. One of the finest lateral load resisting system is the shear wall. which is widely used in construction world. This study includes linear-static and non-linear static analysis of an E-shaped and diaphragm discontinuity G+ 14 multi-story RC building with different shear wall arrangements on dual system such as flat slab and shear wall, moment-resistant frames and shear wall using ETABS software for various irregular designs. Parameters like base shear, storey shear, storey drift, displacement.

Keywords- Dual System, Shear Wall, Flat Slab, Point Displacement, Storey Shear, Storey Drift, Diaphragm Discontinuity.

I. INTRODUCTION

At present in current areas there has been a huge increase in the construction of tall stories and their exceptional concern is about the existence of the structure that should be tall slender [1]. It is therefore critical that these buildings, together with vertical forces, resist horizontal forces. The structure should be addressed with these choices in terms of efficiency, as the buildings are big and slender are subjected to earth quake and wind loads. Because it is a mixture of two load resistant structures, dual system was considered to withstand lateral loads viably. Moment Resistant Frames (MRF) can be used as a dual structure with shear wall and flat slab with shear wall [2]. Shear walls are the most commonly used vertical structures that function as vertical cantilevers to sustainably withstand horizontal loads [3].

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In order to study the structure under breakdown, the efficiency and ductility features of a structure are mandatory. True dynamic analysis is usually not feasible and thus an assessment called pushover assessment is used in latest years that evaluates different parameters such as base shear, displacement, load drifts, etc [4].
In this study, a G+14 Store Reinforced Concrete (RC) buildi ng is analyzed by considering the effect of dual systemfor th is study, special moment resistant frames (SMRF) with shea r wall and flat slab are considered as dual system

II. METHODOLOGY

A G+14 storey building measuring 30m x 25m in plan having E shape with Shear Wall and Flat Slab is modeled in ETABS 2016. There are 5 models analysed in the present study by considering SMRF with shear wall and flat slab as dual system. Shear wall is used for E-shaped models at different locations.

A. Description of Building Structure

The details of the building is given in below Table 1

Table1. Description of Building Structure

STRUCTURE	DESCRIPTION
No of Stories	G+14
Height of one storey	3 m
Height of Base Storey	3.5 m
Soil Type	Medium Soil
Seismic Zone	V
Importance Factor	1
Grade of Concrete	M30 (Column) M25 (Beam and Slab)
Grade of Steel	Fe 415
Size of the Beam	300mmX400mm
Size of the Column	500mmX500mm
Slab Thickness	150 mm
Live Load	3 kN/m^2
Live Load on Roof	2.5 kN/m^2
Floor Finish	1 kN/m^2
Column Drop	300mm

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III. MODELING AND ANALYSIS

For the current research, there are five models considered that include Shear Wall at various places. Models are conducted with equivalent static analysis and push over analysis. Different parameters like base shear, storey shear, storey drift, pushover curves are acquired based on the assessment. It reflects various kinds of models considered for the current research below from Fig1 toFig5.

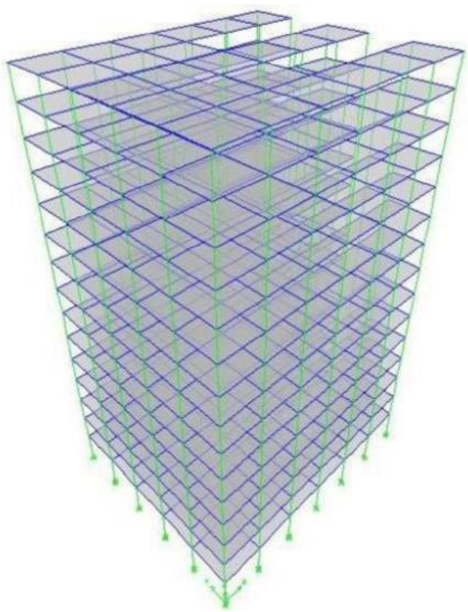

Figure 1. E-Shaped Bare Frame model

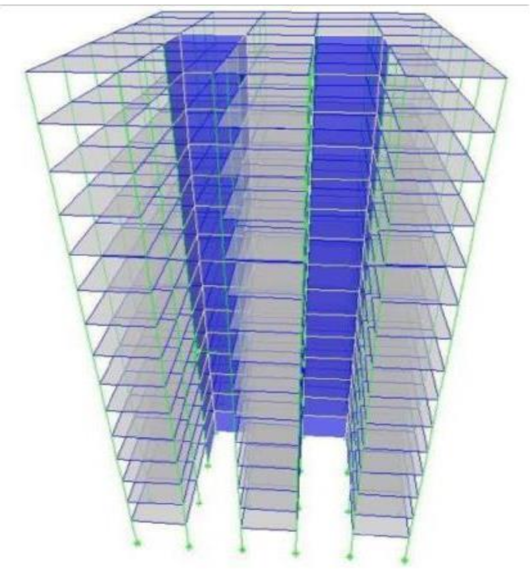

Figure 2. E- Shaped model with SMRF and shear wall at re-entrant corners.

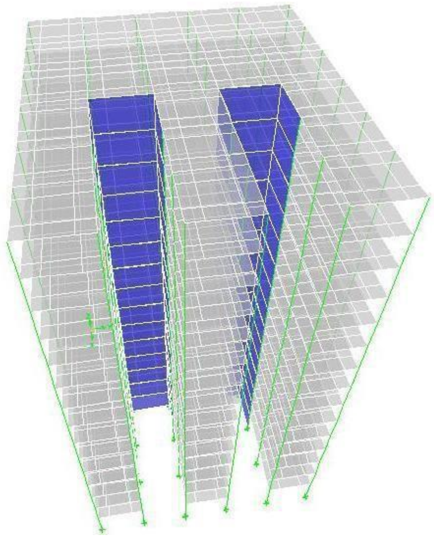

Figure 3. E- Shaped model with SMRF and shear wall at alternate periphery

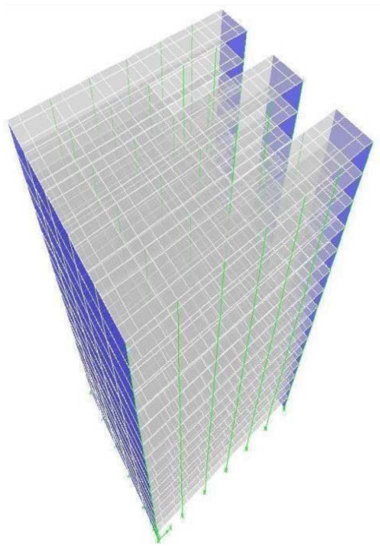

Figure 4. E-Shaped model with Flat Slab and Shear Wall at Re-Entrant Corners

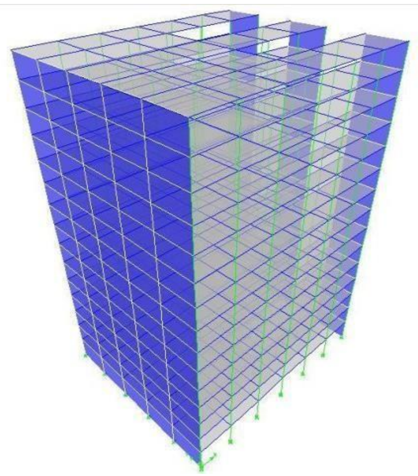

Figure 5. E-Shaped model with Flat Slab and Shear Wall at Alternate Periphery

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IV. RESULTS

The following results for linear static or equivalent static and non-linear static or pushover analysis are tabulated for both the considered models under various load combination as per IS 1893 Part-I 2002.

Here M1= E-Shaped Bare Frame Model

M2= E- Shaped model with SMRF and Shear Wall at re-entrant corners
M3= E- Shaped model with Flat slab and Shear Wall at re-entrant corners
M4= E-Shaped model with Flat Slab and Shear Wall at re-entrant corners
M5= E-Shaped model with Flat Slab and Shear Wall at alternate periphery

A. BASE SHEAR

B. Table2. Base Shear in kN

M1	M2	M3	M4	M5
4805.26	5194.11	5323.72	4880.52	5038.8

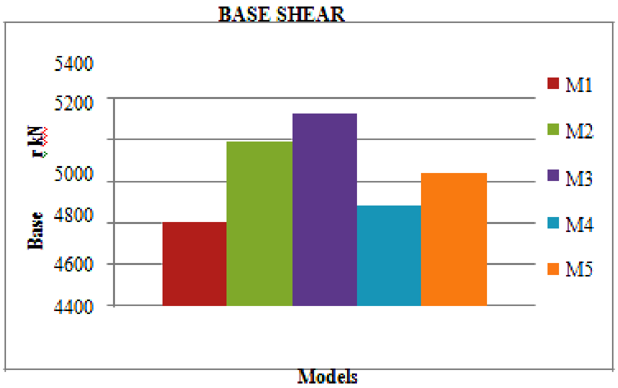

Figure 6. Base Shear for Model 1 to Model 5

B. Storey Shear

Table3. Base Shear for Model 1 to Model 5

Storey No	M1	M2	M3	M4	M5
15	796.87	829.8	840.71	776.16	792.22
14	1562.73	1663.65	1697.24	1560.34	1603.57
13	2224.28	2383.94	2437.11	2237.73	2304.43
12	2789.16	2998.97	3068.87	2816.12	2902.87
11	3265	3517.05	3601.05	3303.35	3406.98
10	3659.43	3946.5	4042.18	3707.22	3824.84
9	3980.08	4295.63	4400.79	4035.55	4164.54
8	4234.59	4572.73	4685.44	4296.15	4434.17
7	4430.58	4786.13	4904.64	4496.83	4641.81
6	4575.7	4944.13	5066.93	4645.42	4795.55
5	4677.57	5055.04	5180.86	4749.73	4903.47
4	4743.82	5127.17	5254.95	4817.56	4973.65
3	4782.08	5168.83	5297.75	4856.74	5014.19
2	4800	5188.34	5317.79	4875.09	5033.17
1	4805.26	5194.11	5323.72	4880.52	5038.80

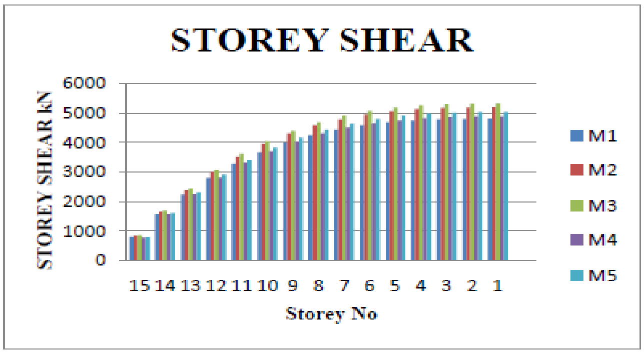

Figure 7. Storey Shear for Model 1 to Model 5

C. Storey Drift

Table4. Storey Drift for Model 1 to Model 5

Storey No	M1	M2	M3	M4	M5
15	0.001729	0.001307	0.001927	0.00106	0.001948
14	0.002251	0.001372	0.001948	0.001121	0.001966
13	0.002789	0.001422	0.001960	0.00117	0.001975
12	0.003267	0.001469	0.001964	0.001217	0.001974
11	0.00367	0.001503	0.001952	0.001255	0.001958
10	0.003995	0.001522	0.001922	0.001279	0.001923
9	0.004246	0.00152	0.001869	0.001286	0.001865
8	0.004429	0.001495	0.001789	0.001272	0.001781
7	0.004549	0.001443	0.001681	0.001235	0.001669
6	0.00461	0.001363	0.001541	0.001173	0.001525
5	0.004616	0.00125	0.001367	0.001081	0.00135
4	0.004556	0.001101	0.001157	0.000958	0.00114
3	0.004386	0.000911	0.00091	0.000797	0.000893
2	0.003932	0.000673	0.000623	0.000592	0.000609
1	0.002382	0.000329	0.000261	0.0003	0.000253

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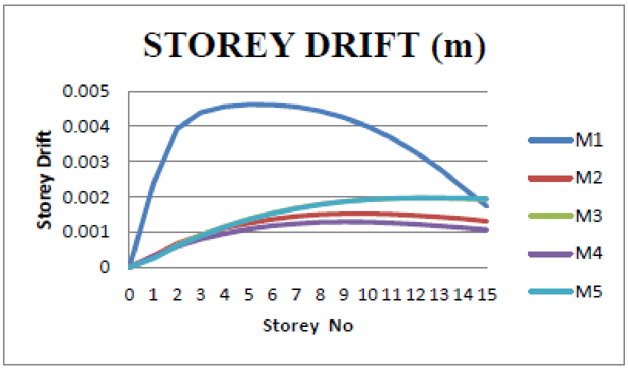

Figure 8. Storey Drift for Model 1 to Model 5

D. Pushover Curves

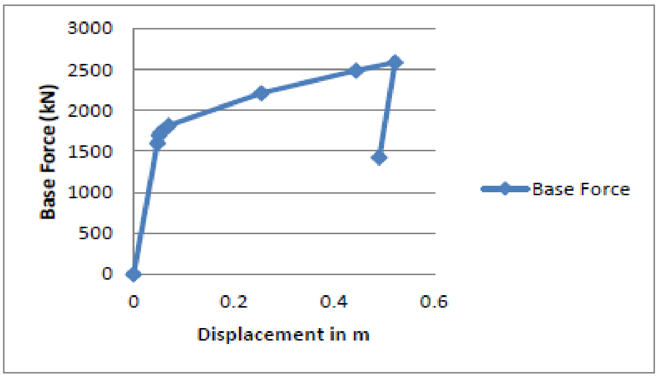

Figure 9. Pushover Curve for Model M1

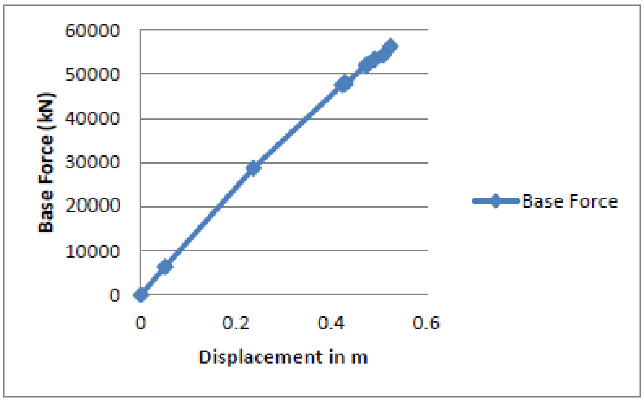

Figure 10. Pushover Curve for Model M2

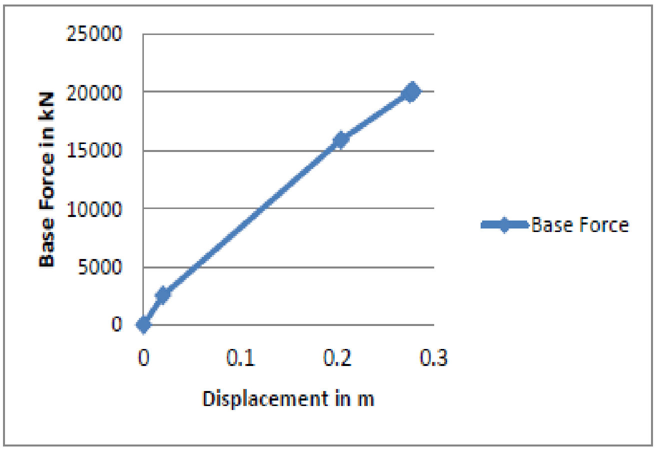

Figure 11. Pushover Curve for Model M3

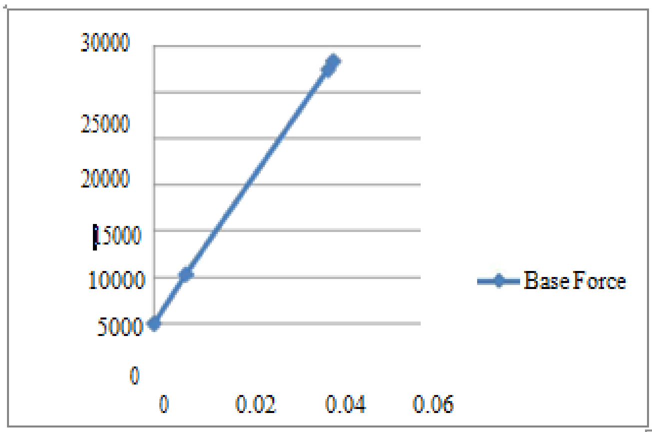

Figure 12. Pushover Curve for Model M4

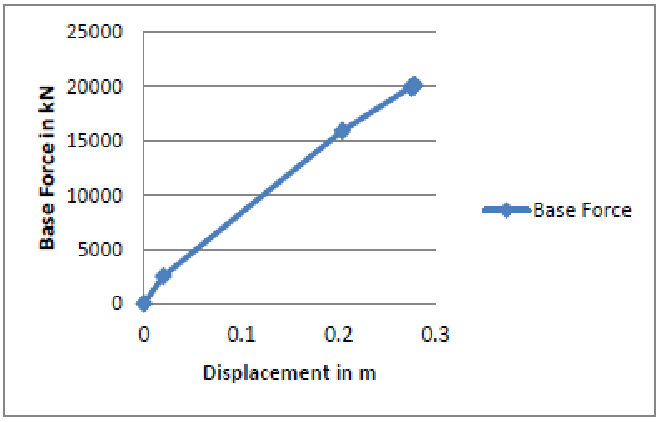

Figure 13. Pushover Curve for Model M5

V. CONCLUSION

1. In E shaped model the base shears and storey shears is found to be highest for flat slab and shear wall at re-entrant corners dual system when compared to all the other E shaped models.
2. Storey Drift is found minimum in E-Shaped model with flat slab and shear wall combination.
3. From the graphs plotted it is clearly seen that the bare frame for model E is the most vulnerable model in the seismic zone V owing to the absence of lateral load resisting system.
4. The post-yield behavior for overall performance level for the G+14 storey RC framed building with various systems considered in this study are found to lie within the life safety range (i-e., LS - CP).

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