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Comparative Seismic Analysis of Multi Storey RC Building by Considering the Effect of Dual System

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ABSTRACT

In General, the structure in high seismic areas may be susceptible to the severe damage. Along with gravity load structure has to withstand to lateral load which can develop high stresses. Now a day, shear wall in R.C. structure and steel bracing in steel structure are most popular system to resist lateral load due to earthquake, wind, blast etc. The shear wall is one of the best lateral load resisting systems which is widely used in construction world. Present study includes linear- static and non-linear static analysis of an E-shaped and diaphragm discontinuity G+ 14 multi storey RC building with different shear wall arrangements on dual system such as flat slab and shear wall, moment resisting frames and shear wall for different irregular plans using ETABS software. Parameters such as base shear, storey shear, storey drift, point displacement and pushover curves are studied.

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

I. INTRODUCTION

At present there has been a gigantic increment in the measure of tall story's in current regions and their extraordinary concern is on the presence of the structure which should be tall slender. Thus it's critical for these structures to oppose horizontal forces along with vertical forces. With these decisions the structure should be dealt with performance wise, since the structures being tall and slender are subjected to seismic and wind loads. Dual system has been perceived to resist lateral loads viably, since it is a combination of two load resisting systems. Moment Resisting Frames (MRF) with shear wall and flat slab with shear wall can be used as a dual system. Shear walls are vertical most ordinarily used structures which act like vertical cantilevers to resist the horizontal loads viably, such a component when joined gives a good performance.

The performance and ductility characteristics of a structure are obligatory in order to study the structure under breakdown. True dynamic analysis is most of the times not viable and hence in the recent years an analysis called pushover analysis is being used which assesses various parameters such as, base shear, displacement, loads drifts, etc. In present study a G+14 storey Reinforced Concrete (RC) building is analysed by considering the effect of dual system, special moment resisting frames (SMRF) with shear wall and flat slab are considered as dual system for the present study.

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

III. MODELING AND ANALYSIS

There are five models considered for the present study which include Shear Wall at different locations. Equivalent static analysis and Push Over analysis are performed on models. Based on the analysis, various parameters such as base shear, storey shear, storey drift, pushover curves are obtained. In below from Fig1 to Fig5 it represents different types of models considered for the present study with Shear wall and Flat Slab.

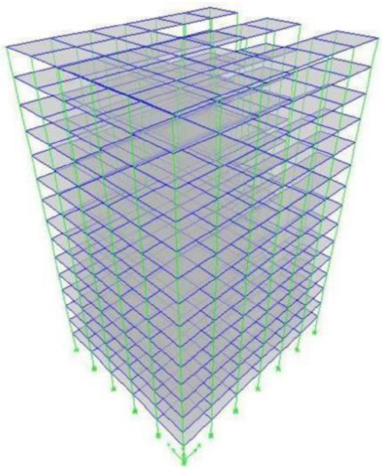


Fig1. E-Shaped Bare Frame model

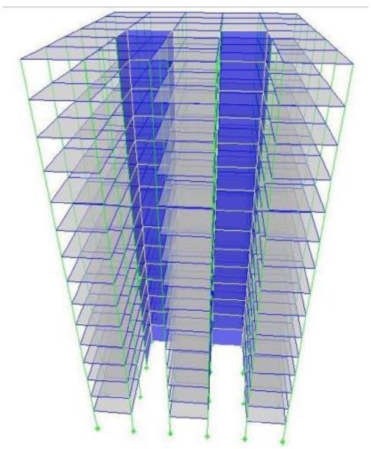


Fig2. E- Shaped model with SMRF and shear wall at re-entrant corners.

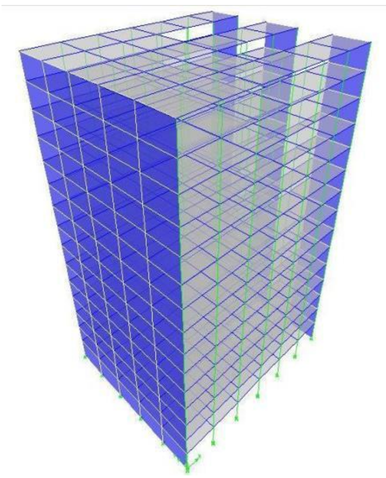


Fig3. E- Shaped model with SMRF and shear wall at alternate periphery

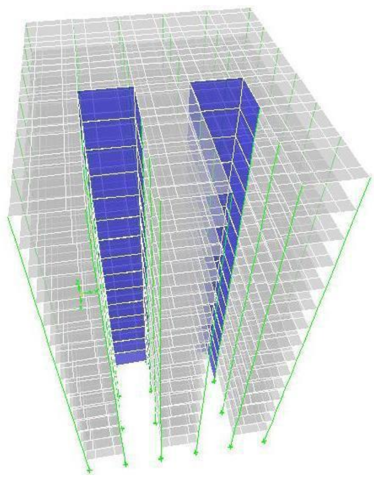


Fig4. E-Shaped model with Flat Slab and Shear Wall at Re-Entrant Corners

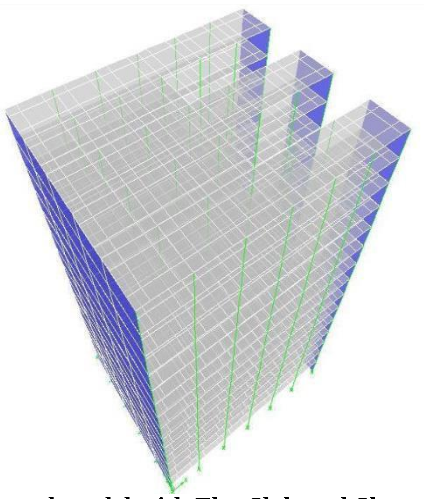


Fig5. E-Shaped model with Flat Slab and Shear Wall at Alternate Periphery

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

Table2. Base Shear in kN

M1	M2	M3	M4	M5
4805.26	5194.11	5323.72	4880.52	5038.8

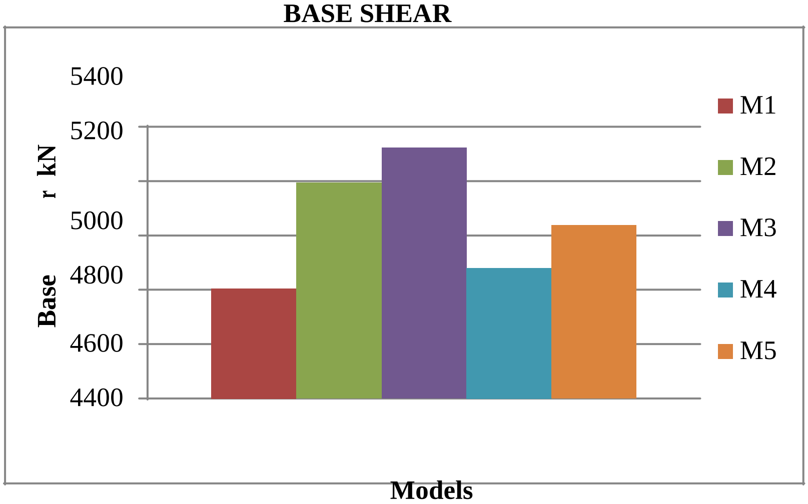


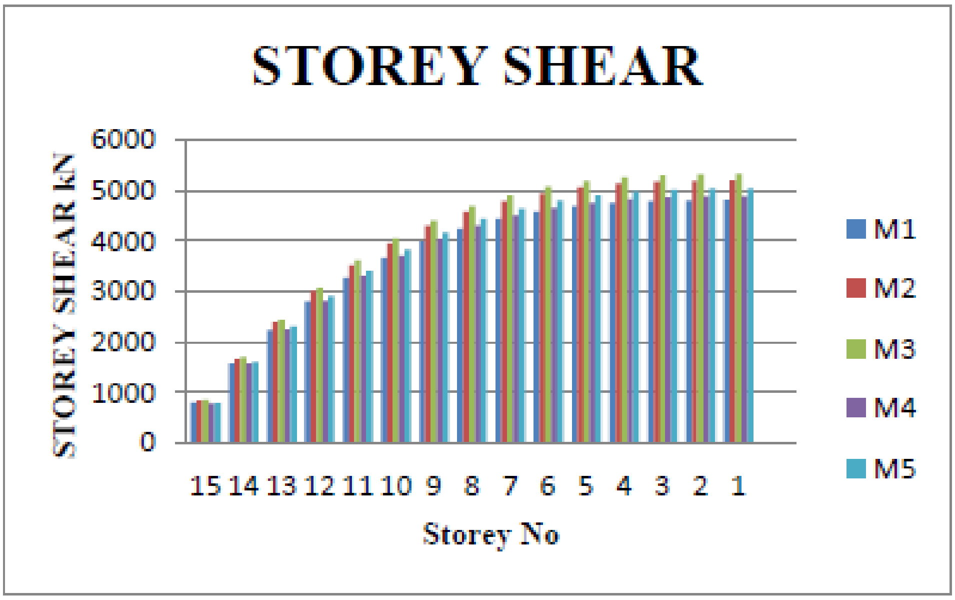
Fig6. Base Shear for Model 1 to Model 5

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



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

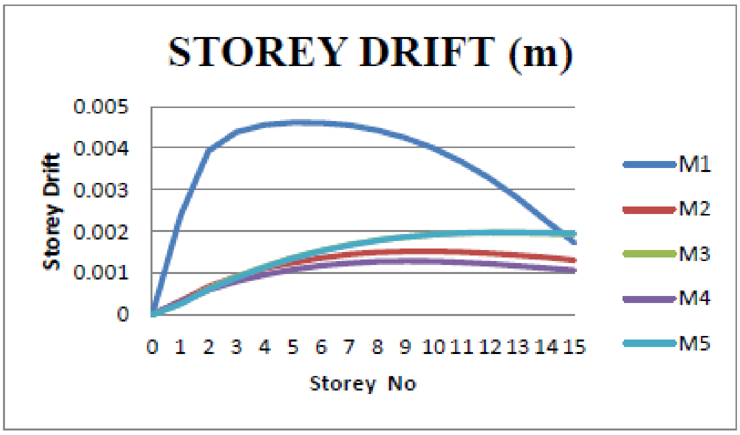


Fig8. Storey Drift for Model 1 to Model 5

D. Pushover Curves

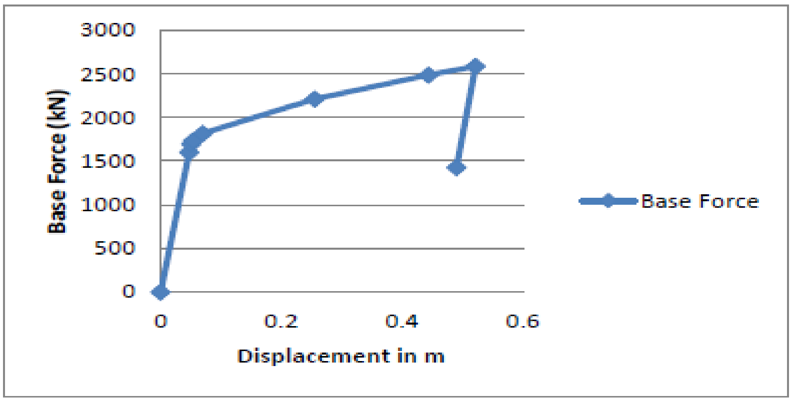
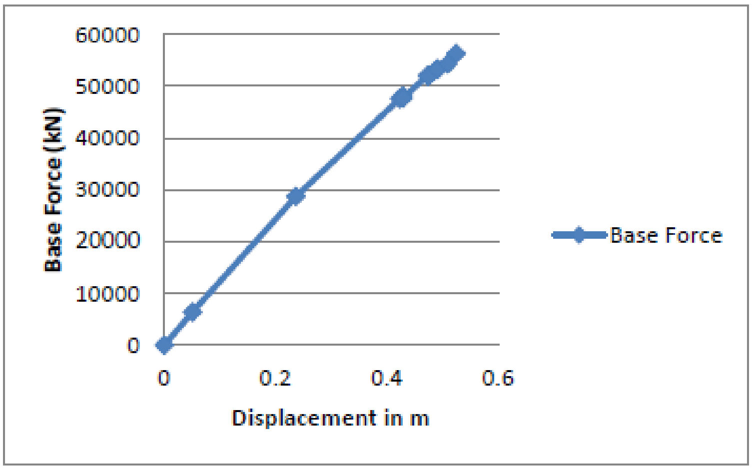


Fig9. Pushover Curve for Model M1



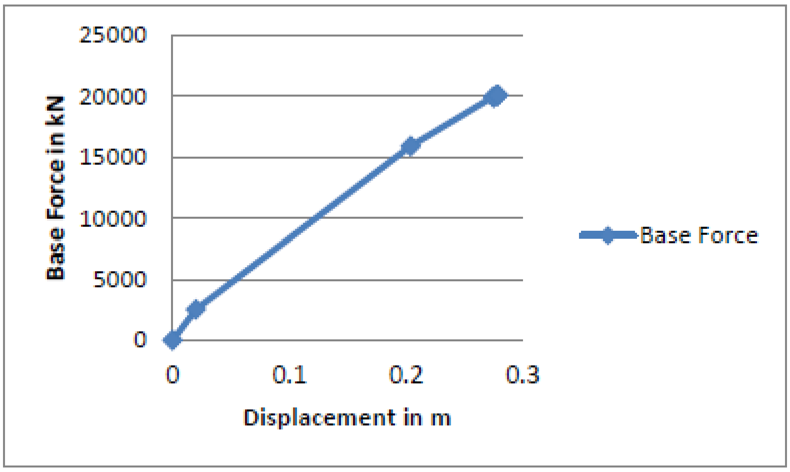


Fig11. Pushover Curve for Model M3

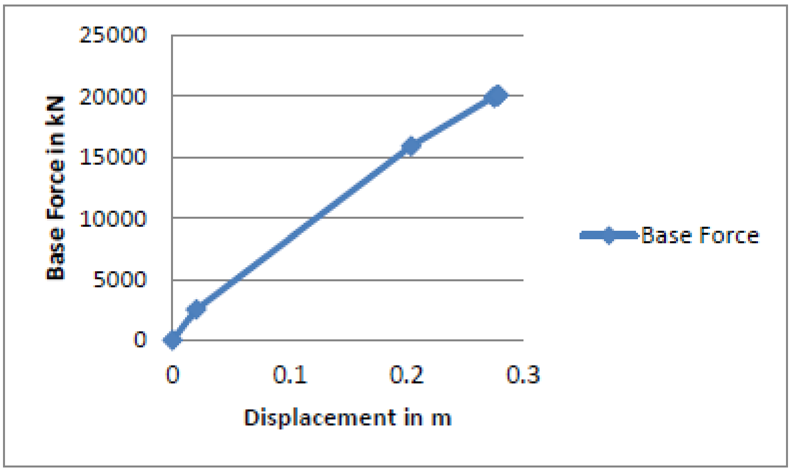


Fig12. Pushover Curve for Model M4

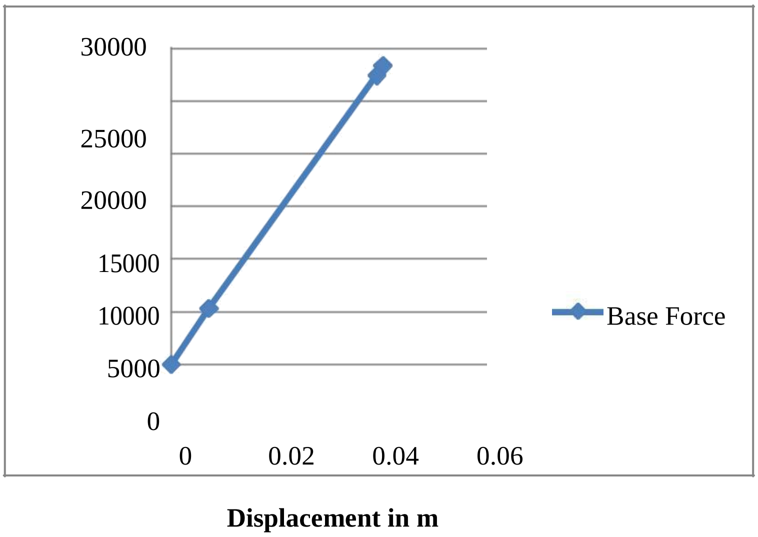


Fig13. Pushover Curve for Model M5

V. CONCLUSIONS

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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