Dynamic Analysis of Multistoried Building with and without Shear Wall.

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Abstract - *In the seismic design of building, understand the effect of position of shear wall on behavior of RC structures. In this paper focus on, 25 storey building have been modeled using software ETABS-2015 by dynamic analysis. Shear walls are structural systems which provide stability to structures from lateral loads. All the analyses have been carried out as per Indian Standard code books. Based on the literature of previous studies effective positioning of shear walls have been chosen. This study is done on multistory building with and without shear wall. Dynamic responses under zone III, India earthquake, as per IS1893(Part 1):2016 and on type of soil is medium have been carried out. Response Spectrum Method is carried out for the results are computed based on storey displacement, storey drift, base shear and time period. Considering the multistoried building, three types of model. Building without shear wall, building with shear wall at middle core, building with shear wall at corners shows the best performance on effective position of shear wall.*

***Key Words*: *Dynamic analysis, shear wall, ETABS, Response Spectrum Method*.**

1. INTRODUCTION

1.1 General

Gravity loads are the essential stacking on a structure. In any case, as a structure gets taller, it should have satisfactory strength and firmness to oppose horizontal burdens forced by winds and moderate tremors. After tremors, the primary components of the structures record harms and some of them even fizzle in different modes. Structures built with underlying dividers are quite often stiffer than outlined constructions, decreasing the chance of unreasonable miss happening. RC multi celebrated structures are satisfactory for opposing both the vertical and level burden.

Shear dividers are upward components of the level power opposing framework. Shear dividers are developed to counter the impacts of horizontal burden following up on a design. In private development, shear dividers are straight outside dividers that ordinarily structure a crate which gives the entirety of the parallel help for the structure. At the point when shear dividers are planned and built appropriately, and they will have the strength and solidness to oppose the flat powers.

1.2 Response spectra analysis

This methodology allows the numerous methods of reaction of a structure to be considered. This is needed in many building regulations for all with the exception of exceptionally basic or complex designs. The primary reaction can be characterized as a mix of numerous modes. PC investigation can be utilized to decide these modes for a design. For every mode, a reaction is gotten from the plan range, comparing to the modular recurrence and the modular mass, and afterward they are consolidated to gauge the complete reaction of the design. In this the greatness of powers every which way is determined and afterward consequences for the structure are noticed. The consequence of a RSM examination from the reaction range of a ground movement is commonly not quite the same as that which would be determined straightforwardly from a straight unique investigation utilizing that ground movement straightforwardly, on the grounds that data of the stage is lost during the time spent creating the reaction range.

2. LITERATURE SUREVY

Prakash A.N. (2018)[1]

studied Analysis of a multi storied building with and without shear wall. In this paper at seismic design of a multi storey to ensure the stability against the lateral force caused by earthquake various methods are used, the most commonly used method is provision of shear wall to the building. Shear wall at corners show minimum displacement and moments hence from all three cases this case can be considered most efficient and safe. In this paper three models are analysed one without shear wall and two with shear wall at different location, one at the corner and one with shear wall at the faces and core of the building.

Mahdi Hosseini, Ai-Askari.(2018)[2]
studied Dynamic analysis of multi storey building with openings in shear wall. In this paper shear wall are added to the building interior to the provide extra strength and stiffness to the building when the exteriors walls cannot provide sufficient strength and stiffness or when the allowable span width ratio for the floor proof diaphragm is exceeds. Two types of shear wall are analyzed to resist forces are: shear forces and uplift forces. Shear powers are made all through the tallness of the divider between the top and base shear divider associations. Elevate powers exist on shear dividers on the grounds that the even powers are applied to the highest point of the divider.

Mahdi Hosseini, Mohammed Farookh, Dr. Hadi Hosseni. (2017)[3]
examined Seismic Analysis of High-Rise Building with L Shape Shear Walls at the Center Core and Corners with Opening. In present work, forty story structures (120m) have been displayed utilizing programming ETABS by unique examination. This investigation is done on RC outlined multistorey structure with RC shear dividers with fixed help conditions. The helpfulness of shear dividers in the primary arranging of multistorey structures has for some time been perceived. At the point when dividers are arranged in worthwhile situations in a structure, they can be productive in opposing sidelong loads beginning from wind or tremors.

Syed Ehtesha,Ali Mohd Minhaj ,Uddin Aquil (2014)[4]
Investigation of solidarity of RC shear divider at various area of multi-celebrated private structure. In this paper, main focus is to determine the solution for shear wall location in multi-storey building. A RCC working of six store's set in HYDERABAD exposed to quake stacking in zone-II is thought of. A quake load is determined by seismic coefficient technique utilizing IS 1893 (PART–I):2002. These examinations were performed utilizing ETABS.They observed that the top deflection is reduced after provisions type 2 shear wall of frame in x-direction as well as in y-direction.

3. Objectives

1)To understand the influence of placement of shear wall in regular reinforced concrete structures.

2)To understand the effect of position of shear wall on behavior of RC structures by comparing following parameters:

- Story displacement
- Story drift
- Time period
- Base shear

3)To predict the better position for the efficient performance of shear wall.

4. Methodology

- In this study, E-TAB model generation generation (column & beam size)
- Defining material property and load.
- Analysis of response spectrum method.
- Obtain result for storey displacement, drift, base shear and time period.
- Compare result for model.
- Conclude result and statement for future scope.

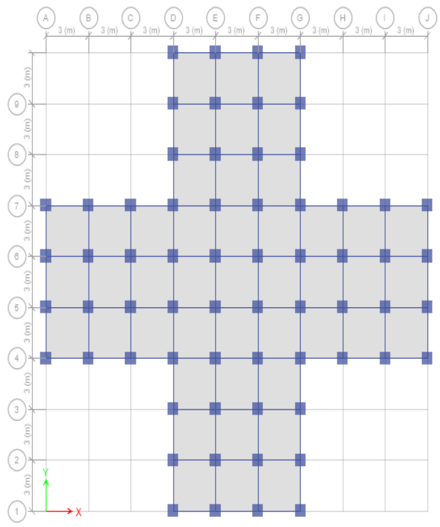

Figure 1. Line plan

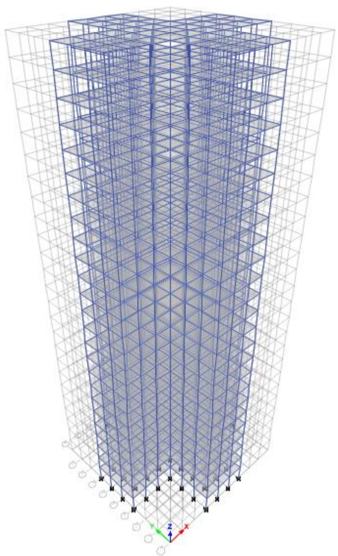

Figure2. View of Building

4.1 INPUT PARAMETERS

1) No. of story:- G+24
2) Location:- Mumbai
3) Zone 3(IS 1893-2016,Part 1, Table-3)
4) Concrete Grade:- M30,M40
5) Reinforcement Grade:-Fe500
6) Type of Building:-Residential
7) Floor Height:- 3m
8) Plinth Height:-0.6m
9) Beam Size:- 250*450mm
10) Column Size:-750*750mm
11) Shear Wall Thickness:-230mm
12) Slab Thickness:-150mm
13) Type of Slab:-Shell Element
14) Floor Dimension in X & Y Directions:- 27m*27m
15) Density of Concrete:- 25 KN/m²
16) Density of Brick:- 9 KN/m²(AAC)

5. RESULTS AND DISCUSSION

5.1 STOREY DISPLACEMENT

1. RS X direction

Table-1: storey displacement in X direction (in mm)

Storey displacement(mm)					
Story	Bare model	Share wall with middle core	Share wall with corners	Share wall with periphery	Share wall with double core
BASE	0	0	0	0	0
25 Story	19.484	18.185	14.826	17.103	16.803
% of reduction	**-**	**6.66 %**	**23.9 %**	**12.22%**	**13.4 %**

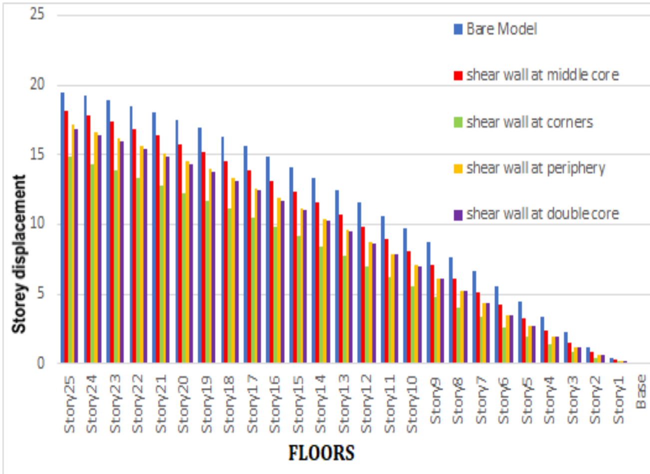

Figure 3. Storey displacement in X direction (in mm)

2. RS Y direction

Table-2: storey displacement in Y direction (in mm)

Storey displacement(mm)					
Story	Bare model	Share wall with middle core	Share wall with corners	Share wall with periphery	Share wall with double core
BASE	0	0	0	0	0
25 Story	19.484	18.185	14.738	17.103	17.328
% of reduction	**-**	**6.66 %**	**24.35 %**	**12.22%**	**11.06 %**

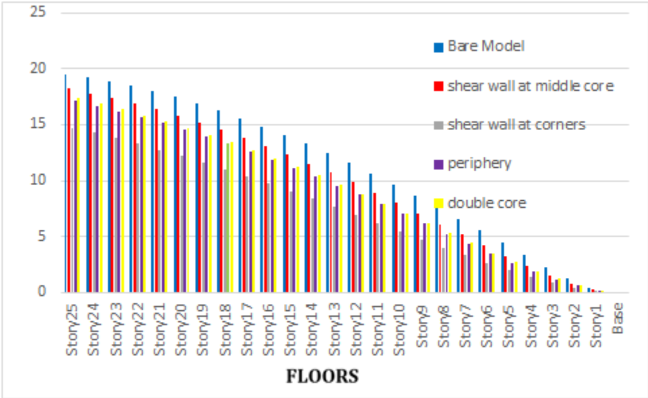

Figure 4. Storey displacement in Y direction (in mm)

5.2 STOREY DRIFT

1.RS X direction

Table-3: storey drift in X direction (in mm)

Storey drift (mm)					
Story	Bare model	Share wall with middle core	Share wall with corners	Share wall with periphery	Share wall with double core
BASE	0	0	0	0	0
25 Story	0.00011	0.000155	0.000169	0.000172	0.000177
% of increment	**-**	**40.90%**	**53.63 %**	**56.36%**	**60.90 %**

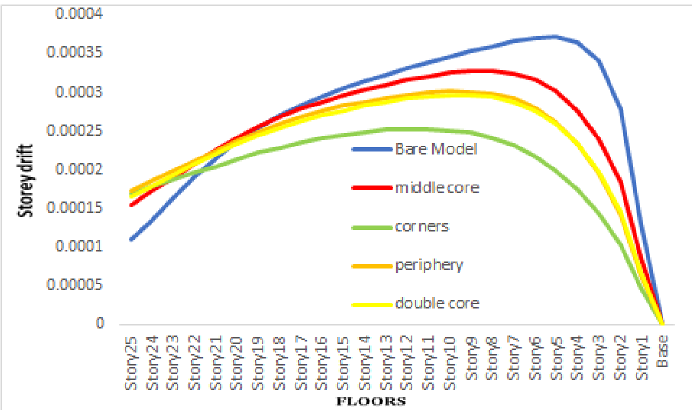

Figure 5. Storey drift in X direction(in mm)

2. RS Y direction

Table-4: storey drift in x & Y direction (in mm)

Storey drift (mm)					
Story	Bare model	Share wall with middle core	Share wall with corners	Share wall with periphery	Share wall with double core
BASE	0	0	0	0	0
25 Story	0.00011	0.000155	0.00017	0.000172	0.000165
% of increment	**-**	**40.90%**	**54.54 %**	**56.36%**	**50%**

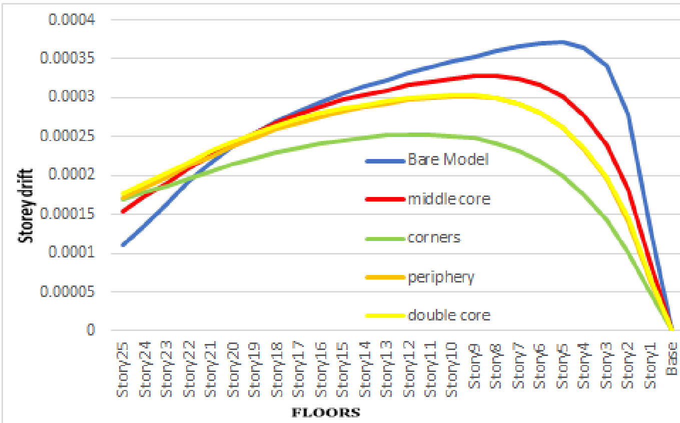

Figure 6. Storey drift in Y direction (in mm)

5.3 BASE SHEAR

1. RS X direction

Table-5: Base shear in x direction (in KN)

Base Shear (KN)					
Story	Bare model	Share wall with middle core	Share wall with corners	Share wall with periphery	Share wall with double core
RS X Max	1575.7312	1810.2229	2553.3853	2054.7384	2000.2541
% increment	-	**14.88 %**	**62.04 %**	**30.39%**	**26.94 %**

2. RS Y direction

Table-6: Base shear in Y direction (in KN)

Base Shear (KN)					
Story	Bare model	Share wall with middle core	Share wall with corners	Share wall with periphery	Share wall with double core
RS Y Max	1575.7312	1810.2229	2555.1816	2054.7384	1971.8361
% increment	-	**14.88 %**	**62.15 %**	**30.39%**	**25.13 %**

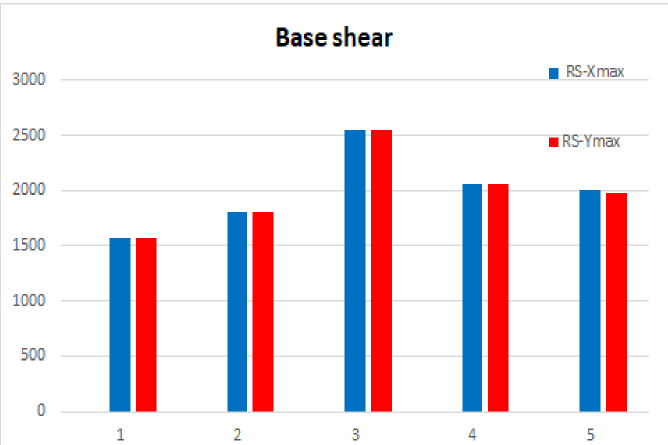

Figure 7. Base shear in X & Y direction(in KN)

5.4 TIME PERIOD

Table-7: Time period (in sec)

Time period (in sec)					
Mode	Bare model	Share wall with middle core	Share wall with corners	Share wall with periphery	Share wall with double core
1	2.44	2.202	1.738	2.053	2.072
2	2.44	2.202	1.736	2.503	2.025
3	2.295	2.06	1.382	1.773	1.855
4	0.784	0.669	0.478	0.597	0.601
5	0.784	0.665	0.478	0.597	0.599
6	0.739	0.665	0.372	0.511	0.592
7	0.438	0.38	0.224	0.294	0.339
8	0.438	0.343	0.224	0.294	0.296
9	0.415	0.343	0.17	0.249	0.294
10	0.296	0.259	0.133	0.178	0.229
11	0.296	0.216	0.132	0.178	0.181
12	0.281	0.216	0.1	0.149	0.18
% of reduction	-	**9.75%**	**28.77 %**	**15.86%**	**18.4%**

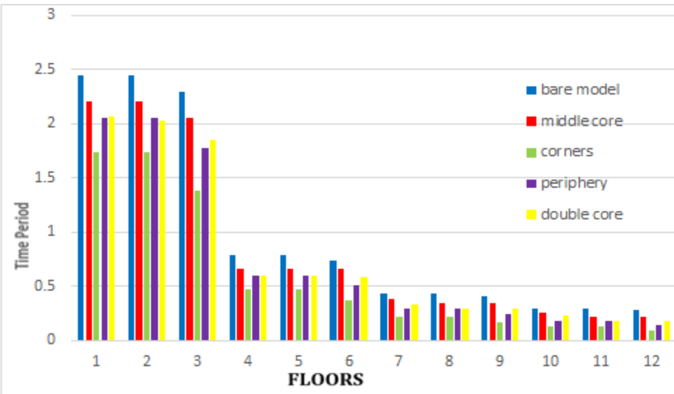

Figure 8. Time period (in sec)

6. CONCLUSIONS

This study reveals that the storey displacement, drift, base shear, time period and the overall seismic response of the structure is affected by the arrangements of shear wall. From numerical results of the present study, the following conclusions may be drawn:

1)In high rise structure, serviceability (displacement and drift) become equally important as that of strength and adding shear wall as central core in bare model displacement is reduced by6.66 % which clearly shows how shear wall is important.
2)After addition of shear wall as central core in bare model, considerable reduction in time period from 2.44 sec to 1.738sec is achieved, this shows the benefit of using shear wall as central core in high rise structure, which is used for installing lifts in the structure.
3)Positioning and the shape of shear walls do not show much difference on base shear but base shear increases with addition of shear wall as stiffness increase.
4)As per analysis, it is concluded that the deflection at different level in multistoried building with shear wall is comparatively lesser as compared to RC building without shear wall.

Hence, we can conclude that building with shear wall shows results in term of storey displacement, storey drift, base shear and time period etc.at the same time considering shear wall position at corners perform better under seismic load.

7. FUTURE SCOPE

Within the limited scope of the present work, the broad conclusions drawn from this work have been reported. However, further study can be undertaken in the following areas: 1) The study of changing position of shear wall can be done by variation of shape and sizes of shear wall.

2) Flexible foundation is not considered; therefore, work can be repeated by soil structure interaction.

3) This study could be extended by including various other parameters such as torsional effects and soft storey effects in a building.

4) The structure with vertical or horizontal irregularity can be considered for future study.

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IS – 875 (Part 2) – 1987
IS – 875 (Part 3) - 1987
IS – 1893 (Part 1) – 2016