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Analysis of RC Frame Structure with Shear Wall and Floating Column

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Abstract – *Conventional R.C frame structure and floating column structure, shear wall are modelled and analyzed for the different combinations of static loading with multistoried building. The comparison is made between the regular and irregular conventional floating column structure and RC frame structure of* ***15 storey without shear wall and with shear*** *wall a t different locations. The main objective of the analysis is to study best and economical structure in regular and irregular structure in RC framed structure and floating column structure with and without shear wall at different location. The analysis is carried out using* ***ETABs 2017*** *software Present work also provides a good source of information on various parameters like storey displacement, storey drift, time period. This study will help to find torsion free and economical high rise Building structures*.

1 INTRODUCTION- Generally the analysis of floating column structure is not complex but it is also important to study the behaviour against different forces acting on the components of a multistoried building. The analysis may be carried out using software like Etabs 2017 . In this dissertation work, modern R.C.C structure i.e floating column, shear wall for different locations are modelled and analyzed for the different combinations of static loading with corner shear wall and middle shear wall with varying geometrics of multistoried building .The comparison is made between the conventional R.C.C floating column structure and RC frame structure of 15 storey without shear wall and with shear wall at different shear wall locations.

1.1 Floating Column - A column is supposed to be a vertical member starting from foundation level and transferring the load to the ground. The term floating column is also a vertical element which of the column ends due to structural design or site condition, rests on the beam that is in horizontal member. These beams turns the load transfer to the below columns. These columns load was considered as the point load. Where indicating the floating columns, in that floor and below floors beams and columns should be in heavy in size and heavy material will used. Because floating columns load transfer the load horizontal beam and act on concentrated load so beams and columns sizes should be increased

1.2 Shear Wall - A shear wall is a wall used to resist the shear, produced due to earthquake loads or lateral forces. Shear wall commonly provided in high rise building. It will introduced from foundation level up to extended to the building height. Shear wall thickness may vary from 150mm to 400mm. shear wall oriented in vertical direction like wide beams to resist the lateral forces to downwards to the foundation .Providing the shear wall commonly by width and length of the structures. When the centre of gravity of building and load carried by building it differs more than 30%, in that case shear wall will be provided. So concrete shear wall will provided the structures to bring centre of gravity and centre of rigidity in range of 30% because lateral force will not increase

2. LITERATURE REVIEW –

N. Saravanan[1], Dr. T. Kavitha[2] et.al. 2020[1]

] In this the effects of soft storey configuration in the buildings are studied and focus is given on the various ideal location of RC shear wall to remedy it. The performance of the building is evaluated in terms of lateral displacement, storey drift, storey shear and bending moment variation. The results for different models are compared with the normal structure.

Shubham Mandwale[1], Nikhil Pitale[2] et.al. 2020 [2]

] In this studies carried out on analysis of structure with floating and without floating column, also studied seismic analysis of RC framed building for different strata and studied comparison of shear wall structure included floating column structure for the parameters displacement, storey shear, time period and base shear of structure under earthquake excitation.

Shivam Wankhade[1], Prof. M. Shahezad[2] et.al. 2019 [3]

The seismic behaviour of buildings with floating columns and without floating columns for different structural complexities. It was observed that, provision of floating columns at different locations affects the performance of building during earthquake also different parameters such as storey drift, storey shear, displacement increases.

Shivani Barde[1], Nitesh Kushwaha[2] et.al. 2019 [4]

In this study the behavior of building frame with and without floating column is studied under static load, Dynamic load and seismic loading condition. comparative study of the behavior of multistory buildings with and without floating columns with Conner shear panels under same loading condition for both buildings. Both buildings are analysis for wind load and seismic loading condition.

3. OBJECTIVES OF THE STUDY –

- To evaluate seismic analysis of regular and irregular shapes of RC framed structure using floating column.
- To evaluate the behaviour of RC framed structure with regular and irregular shapes for different location of shear wall.
- Comparison of results of regular and irregular building with or without floating column.
- Validation of software by using simple structure

4. METHODOLOGY –

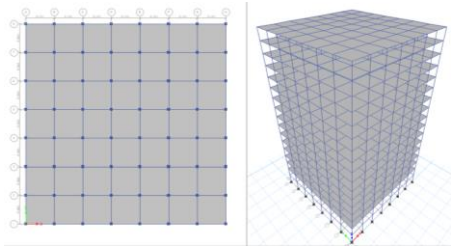
1. Collection of required data to carry out the analysis from journals, technical magazines reference books and web source.
2. Preparation of basic models of floating column structure with regular and irregular shapes by using finite element based software.
3. To study seismic behavior of floating column structure in terms of parameters such as Maximum displacement, Time period, Storey drift and Base shear.
4. Comparison to be made between these analysis to known seismic behavior of floating column structure.
5. To study behaviour of floating column structure with regular and irregular shapes for different location of shear wall.
6. From the results of analysis the final conclusion will draw.

Theory of lateral loads on high rise building

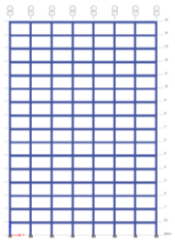
Earthquake analysis for High Rise buildings

RCC tall buildings are adequate for resisting both the vertical and horizontal load. When such building is designed without shear wall, beam and column sizes are quite heavy and there is problem arises at these joint and it is congested to place and vibrate concrete at these places and displacement is quite heavy which induces heavy forces in building member. Shear wall may become essential from the point of view of economy and control of horizontal displacement. The residential medium rise building is analyzed for earthquake force by considering two type of structural system. It has always been a human desire to create taller and taller structures so in recent days there is a considerable increase in the high rise buildings and the modern development is headed for more tall and slender structures. Every structural engineer is met with the problem of giving sufficient strength and stability of these tall buildings against lateral load thus the effect of lateral loads like wind loads, earth quick loads and blast forces are attaining escalating importance. For the reason of the accessibility and availability of developed software in engineering design activities, optimization algorithms are becoming more popular. Wide applications of this kind of software are in the design engineering problems where a specific goal is to minimize or maximize a certain parameters.

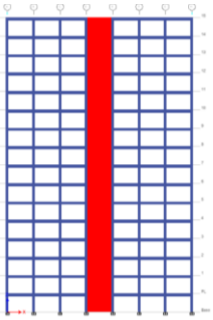
Seismic Analysis Method: For the determination of seismic responses there is necessary to carry out seismic analysis of structure. The analysis can be performed on the basis of external action, the behavior of structure or structural materials and the type of structural model selected. Based on the external action and behavior of structure, the analysis can be further classified as 1) Linear static analysis 2) Nonlinear static analysis, 3) Linear dynamic analysis 4) Nonlinear dynamic analysis. Linear static analysis or equivalent static method can be used for regular structures with limited height; linear dynamic analysis can be performed by response spectrum method. The significant difference between linear static and linear dynamic analysis is the level of the forces and their distribution along the height of structure. Nonlinear static analysis is an improvement over linear static or dynamic analysis in the sense that it allows inelastic behavior



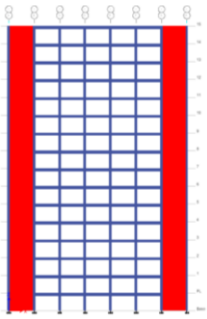
3 D MODEL



WITHOUT SHEAR WALL



CENTER WALL



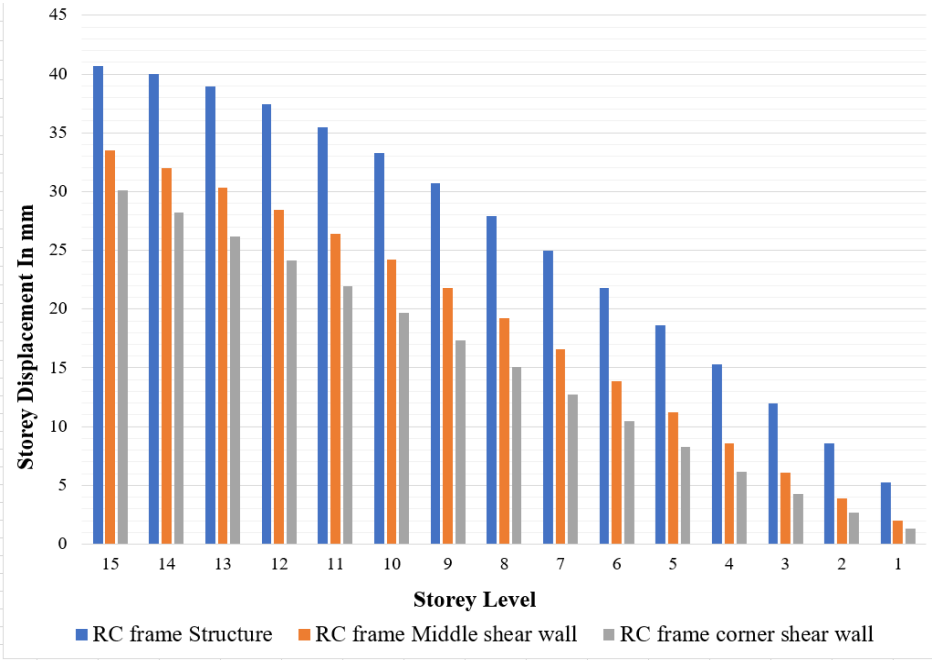
SIDE WALL

Storey	Elevation (m)	RC frame Structure (mm)		RC frame Middle shear Wall (mm)		RC frame corner shear Wall (mm)	
		X dir.	Y dir.	X dir.	Y dir.	X dir.	Y dir.
15	56	40.652	40.652	33.511	33.511	30.138	30.138
14	52.5	40.022	40.022	32.004	32.004	28.213	28.213
13	49	38.951	38.951	30.332	30.332	26.200	26.200
12	45.5	37.429	37.429	28.481	28.481	24.106	24.106
11	42	35.507	35.507	26.434	26.434	21.929	21.929
10	38.5	33.243	33.243	24.197	24.197	19.680	19.680
9	35	30.693	30.693	21.790	21.79	17.377	17.377
8	31.5	27.909	27.909	19.243	19.243	15.048	15.048
7	28	24.936	24.936	16.596	16.596	12.723	12.723
6	24.5	21.819	21.819	13.899	13.899	10.442	10.442
5	21	18.595	18.595	11.206	11.206	8.246	8.246
4	17.5	15.296	15.296	8.584	8.584	6.185	6.185
3	14	11.953	11.953	6.111	6.111	4.309	4.309
2	10.5	8.592	8.592	3.882	3.882	2.679	2.679
1	7	5.242	5.242	2.016	2.016	1.362	1.362

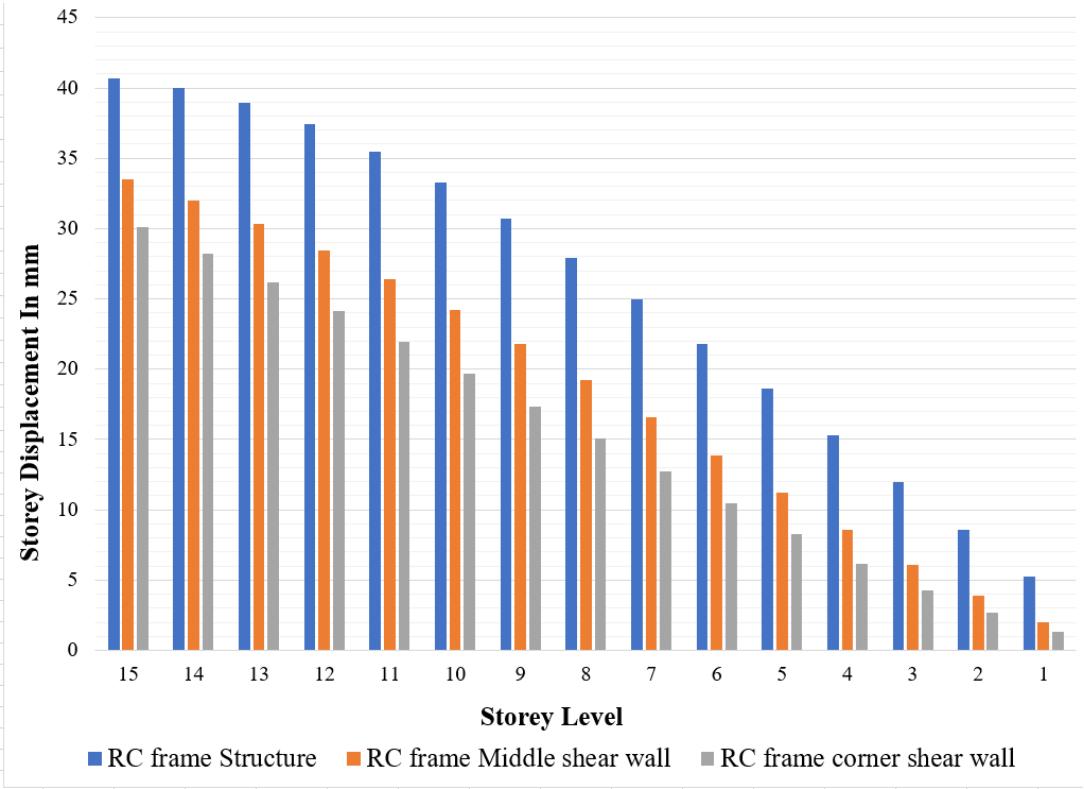
Combined Table Of RC Frame Structure

5. RESULT AND DISCUSSION-

5.1 STOREY DISPLACEMENT-



storey displacement in X direction.

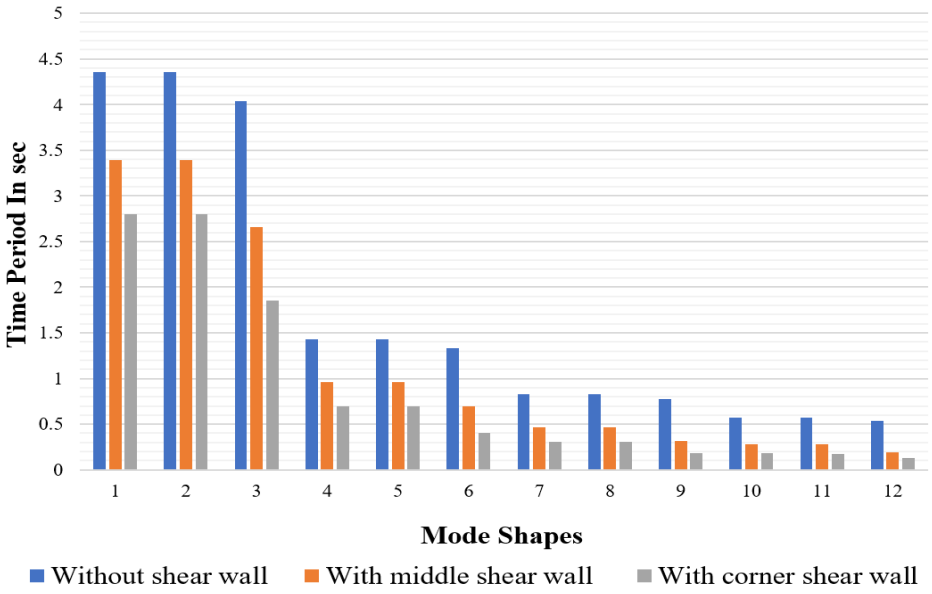


Storey displacement in Y direction.

5.4 TIME PERIOD –

Variation of time period building of for different position of shear wall.

Time period	Without shear wall (sec)	With middle shear wall (sec)	With corner shear wall (sec)
1	4.357	3.392	2.801
2	4.357	3.392	2.801
3	4.040	2.657	1.850
4	1.430	0.962	0.699
5	1.430	0.962	0.699
6	1.328	0.700	0.403
7	0.829	0.462	0.311
8	0.829	0.462	0.311
9	0.775	0.313	0.185
10	0.572	0.276	0.185
11	0.572	0.276	0.173
12	0.535	0.188	0.129



CONCLUSION –

1) Best and Economic structure is RC Frame with Shear Walls are at corner of the building
2) RC frame with Shear Walls at corner attract less torsion in the building. So it is good structural system from earthquake point of view.

3) Time period is less in RC frame with Shear Walls at corner, it gives more stiffness. Hence building will be more stable from strength and serviceability point of view.
4) Compared to other system RC frames with shear walls at corner gives less storey drift values and less storey displacement values.
5) Building should be designed in both directions independently for critical forces of earthquake separately.
6) This system provide very good lateral stiffness due to which acceleration values are well with comfort level acceleration.
7) This system is good for high rise structures where lateral loads are predominant but for supper high rise structures having height more than 250m special framing system like tube holds good.

SCOPE FOR FUTURE WORK-

1) Study can be done to make earthquake resistant building by providing both base isolation and other passive dampers to the structure.
2) Study can be done provide outrigger Girder to the structure.
3) Study can be done observed by performing time history analysis, pushover analysis
4) Study can be improved by providing bracing structure.
5) Study can be improved by providing dead space
6) In this study we consider regular and irregular shape of building same analysis can be performed by varying shape of building such as circular, oval, tapered.

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