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Comparative Study of RC Multistorey Building with Floating Column and Shear Wall Subjected To Seismic Load

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Abstract : In modern multistorey building construction, irregularities like the soft storey, vertical and plan irregularities, floating columns etc are very common. Building with an open ground storey for parking is a common feature that results in floating columns. Floating columns provide column free space and a good aesthetic architectural view of the building. floating column means the end of any vertical element that rests on the beam which leads to discontinuity of columns such that the path of load distribution in multi-storey buildings is disturbed. The use of a floating column also tends to increase the moment in the column, storey shear etc which highly undesirable in seismically active areas. So, the study of the best location where the floating column needs to be provided to reduce the impact due to seismic loads is of primordial importance.

Shear wall is a vertical member which is provided from foundation to top storey. In this study shear wall is used in the direction of orientation so that it provides additional strength and stiffness to the buildings.

In the present analysis, 8 models are studied. The first model considers a multi-storeyed building without any shear wall and floating column. Other models analysed are with shear wall and by varying the location of floating columns. The analysis and design are done by STAAD.pro V8i SS6 version software and the method used is response spectrum analysis in earthquake zone 4. The effect of floating column location on parameters such as Base shear, Displacement, Maximum moment, storey shear and percentage of steel reinforcement are discussed. The comparison of results of different models is also carried out in detail using graphs and bar charts in this study. The suitable location for providing a floating column with the shear wall is also discussed.

Keywords: Floating column, Shear wall, Seismic load, STAAD.pro.v8i, Response Spectrum Analysis.

I. INTRODUCTION

A. General

In the present day of building construction in urban cities parking space and reception lobbies etc. are the main problem arising in the multistorey buildings due to the increasing population. For this, there is a need for having column-free space, and for a good aesthetic view of the building and other functional requirements. To overcome this problem many multistorey buildings all over the world today have some open storey as an unavoidable feature. A column is a vertical member starting from the foundation level and continuing up to the top floor of the building and transferring the load to the ground below the foundation. In a floating column, the column is resting on the beam at any level of the multistorey building for extra column space. Due to the floating column, there are vertical irregularities in the structure as distribution of load in the structure are from slab and beam i.e., horizontal member to the column and wall i.e., a vertical member is disturbed. A shear wall is a vertical member which is used in multistorey building to resist lateral force and shear force. Providing shear wall along with the floating column makes the structure more stable and also economical.

B. Floating Column

A column in a structure is a vertical member that starts from the ground foundation and goes to the top storey of the structure. All the load of the structure are transferred from the column to the foundation and the to the ground. Floating column means that the vertical member such as column does not rest on the ground or another column beneath. It rests on the beam so the space of the column can be utilised, and it transfers the load to the beam and then the beam transfers the load to another column. Now a days floating column can be easily seen in almost all the RC multistorey building over the conventional multistorey building. floating column provides essential free space that can be utilised for many purposes for example parking space on the ground floor, meeting hall on any of the floor. floating column must be properly detailed and designed, specifically in the zone which is prone to earthquake. The floating column act as the point load upon the beam in which it rests. floating columns provide irregularities in the structure which affect the path of distribution of the load.

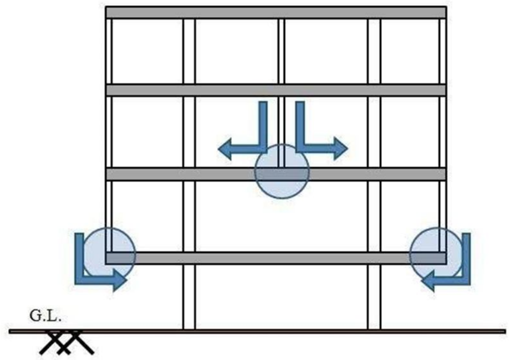

Figure 1.1: load distribution of floating column

C. Shear Wall

A shear wall is a vertical member which is used in multistorey building to resist lateral forces and shear forces which causes damage to the structure at the time of the earthquake. Shear wall designs according to the code of shear wall which is mandatory in high rise building especially in an area which is prone to earthquake. Architects and engineers provide their essential knowledge in designing a shear wall to make the structure safer and more stable during an earthquake. Providing of floating columns can be stated chiefly that buildings in many sites as covering the maximum suitable area. While a vertical structural element (shear wall) will be carrying the side forces in the wall levels during both shear and bending. This wall element effects like a part of the beam of its strength originated from its depth. The high strength and stiffness are provided from the shear wall to the construction of multi-storey buildings, that approach to diminish the side sway of the structure and by decline harm to building.

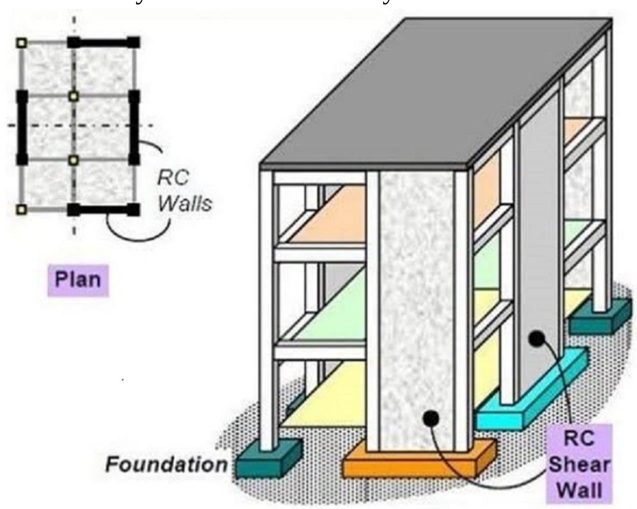

Figure 1.2: plan and elevation of shear wall

D. Objective of the Project

The objective of the present work is –

1) To check the behaviour of multistorey building with and without Floating column and shear wall.
2) To provide the suitable location of the floating column in a multistorey building.
3) In earthquake prone area making the structure more stable and economical.

E. Need for the Present study

In present day spacing is becoming a very serious problem as the population is increasing rapidly in urban cities. To increase the parking space, reception or lobby space floating column are used which makes the structure more vulnerable to damages in the earthquake prone zone and the shear wall provides mass and stiffness to the structure.

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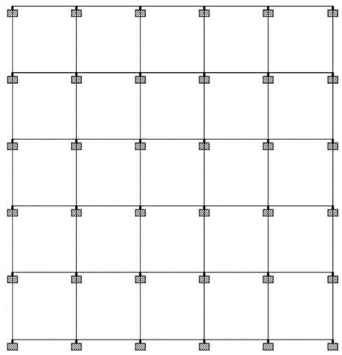
II. METHODOLOGY

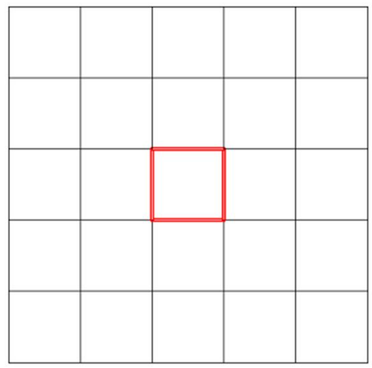
The current study involves analysing the parametric study which was done for specific high rise building without floating column and with the floating column at different location of the building and constant shear walls at a specific location. special moment resisting frame multistorey building is situated at zone 4 of the seismic zone. In this modelled slab and shear wall are assigned as area cross-section as a thin shell. The building is modelled using the software STAAD Pro. V8i.

A. Modelling

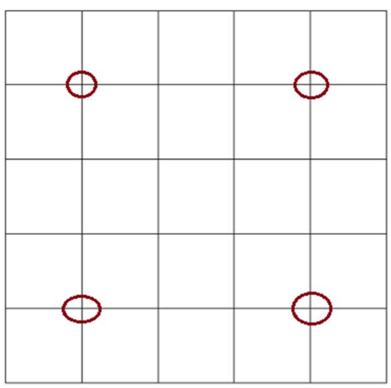
There are several cases studied below



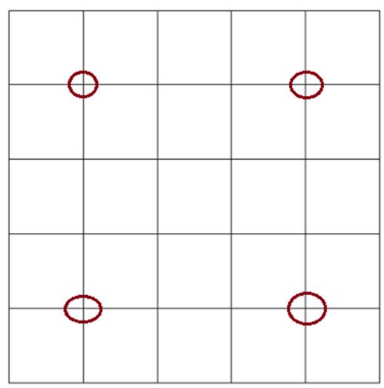
Case 1 : - Normal structure



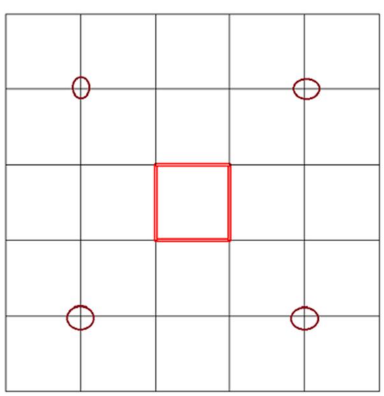
Case 2 : -Normal structure with shear wall



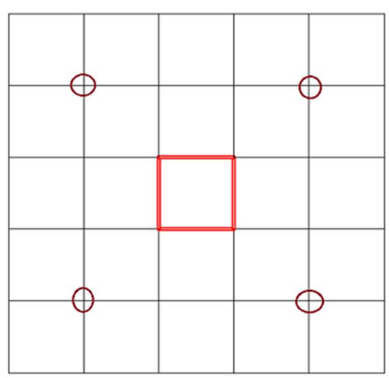
Case 3: removing the 4 columns in the ground floor



Case 4: removing the 4 columns in the second floor



Case 5: removing the 4 columns in the ground floor centrally core (Box type)



Case 6: removing the 4 columns in the 2nd floor with shear wall in with shear wall in centrally core (Box type)

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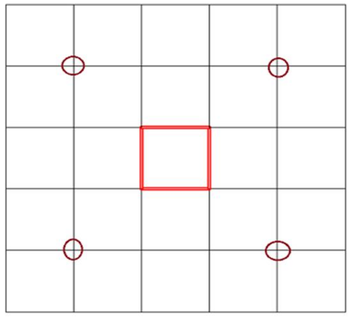
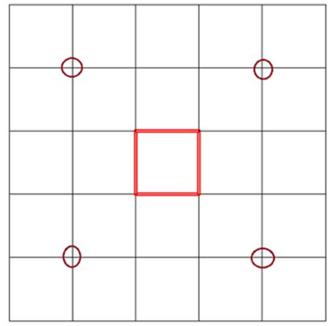


Case 7 : removing the 4 columns in the 4th floor centrally core (Box type)



Case8: removing the 4 columns in the 6th floor with shear wall in with shear wall in centrally core (Box type)

B. Data For The Analysis

Following data used in the analysis of the RC frame building model

Table 1 Summarized of specifications

Description	Information
Plan size	20x20m
Number of basements below ground	0
Number of stories above ground	G+6
Building height	22.40m
Type of structure"	RC frame structure
Type of building	SMRF
Grade of concrete	Fc 25
Grade of steel	Fe415
Software used	STAAD.pro. V8i
Beam dimensions	450x230mm, 350x230mm 500x300mm 400x230mm
Column dimensions	650x650mm 500x500mm 700x700mm

Table 2 (Building data).

Specifications	7 storey
Shear wall thickness	230mm
Unit weight of concrete	25kN/m3
The live load	2 KN/m3
The floor finishing load	1.5KN/m3
Importance factor	1
Seismic zone factor	0.24
Response reduction factor	5
Soil type	II (Medium)

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III. RESULTS AND DISCUSSION

A. General

The various models such as a bare frame with floating column without shear wall and floating column with shear wall at different position have been analysed using STAAD Pro. V8i. The following results for various parameters are obtained.

B. Base Shear

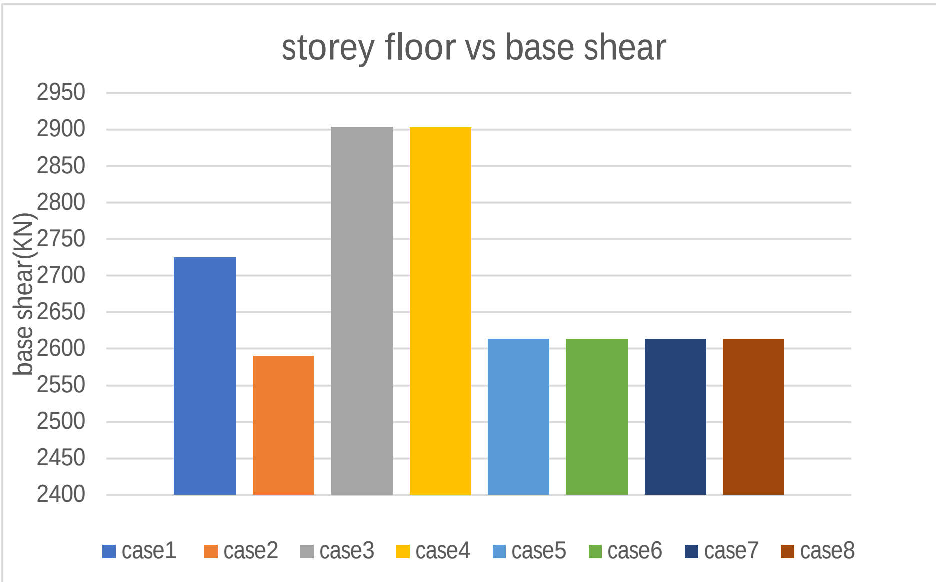

Fig. 3.1: - base shear (KN)

C. Displacement

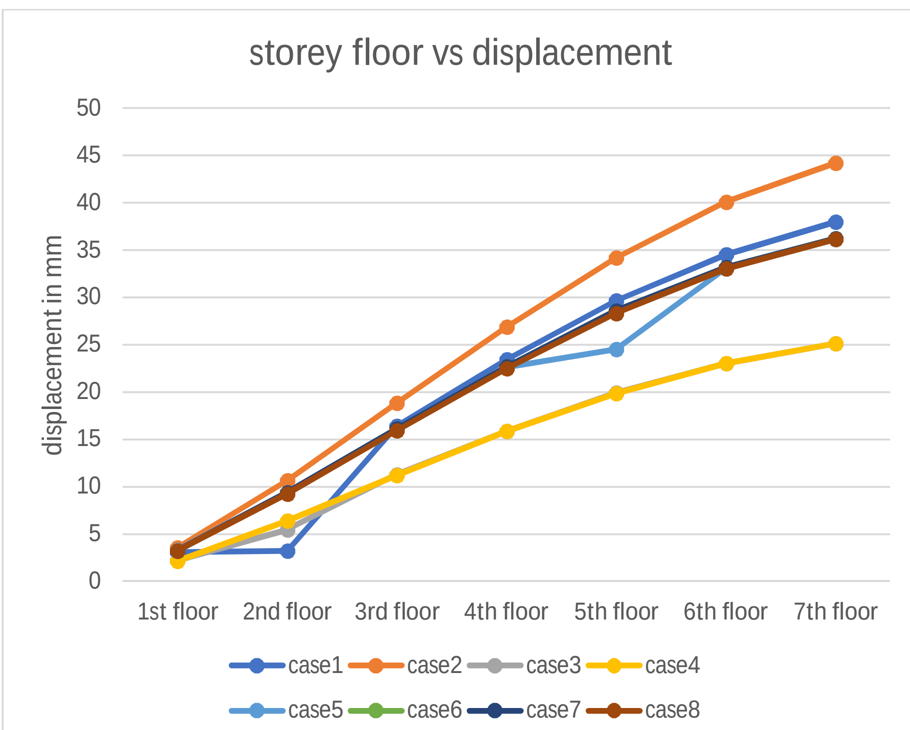

Fig.3.2: - displacement in mm

D. Maximum Moment

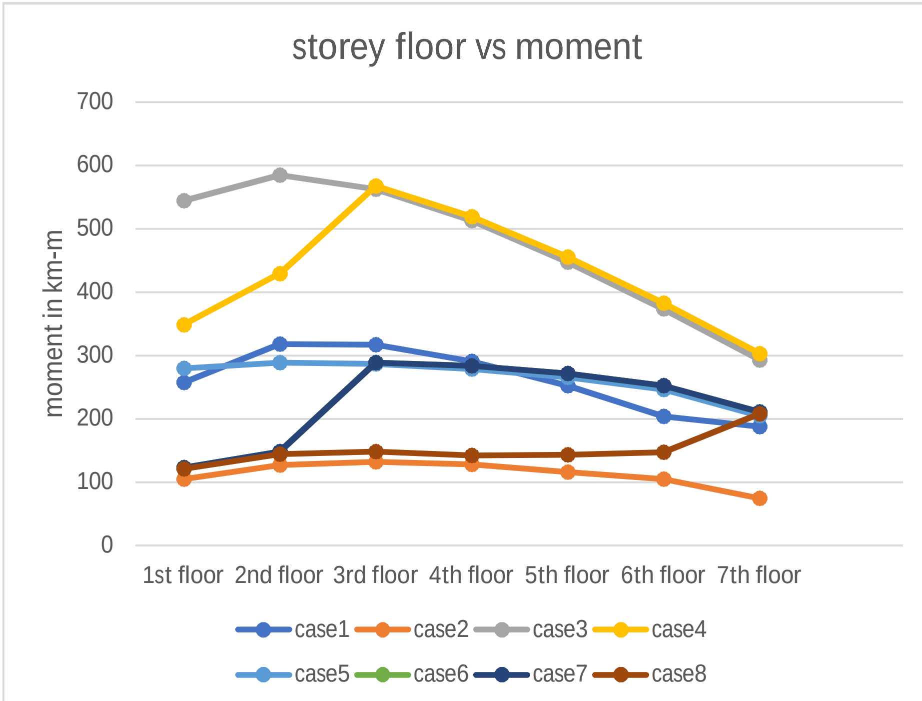

Fig.3.3: - moment in km-m

E. Storey Shear

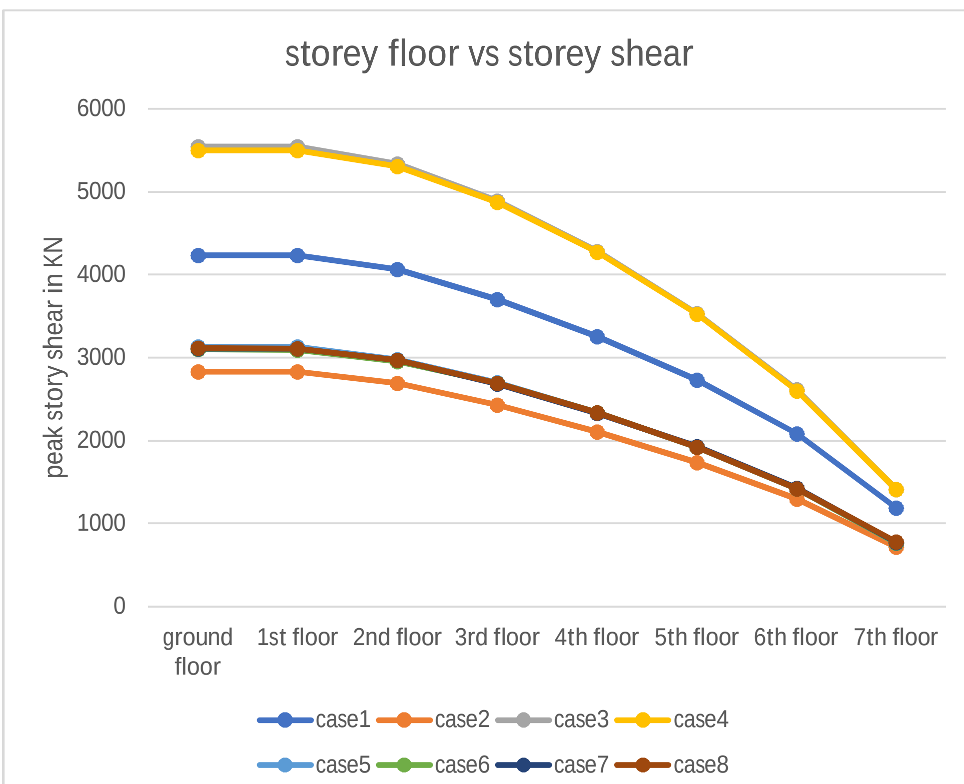

Fig.3.4: - storey shear (KN)

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F. Area of Reinforcement Required

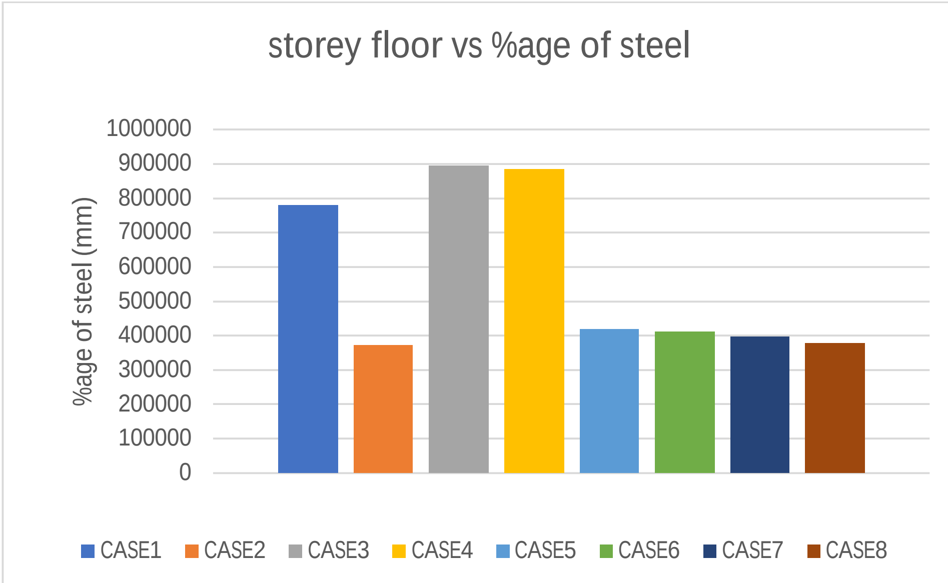

Fig.3.5: - percentage of reinforcement(mm)

IV. COMPARISION OF ANALYSIS RESULTS

From the above results, all the readings are all cases are compared to the Normal Building and the observations are as follows:

A. The base shear in case3 and case4 has increased maximum value as compared with the normal structure.
B. The nodal displacement in case 2 has increased value and case3 and case4 has minimum value as a compared with the normal structure.
C. It was observed that the maximum moment for the normal building is 318.42 KN-m on the 2nd floor, the maximum moment occurred among all the cases is case 3 is 584.35KN-m on the 2nd floor.
D. The peak storey shear in case3 has maximum value as compared with the normal structure and all the other cases.
E. The maximum percentage of steel reinforcement is 895753mm2 in case3 and minimum percentage of steel reinforcement is 379013mm2 in the case2 as compared to the 779966mm2 in case 1 i.e., normal structure.

V. CONCLUSIONS AND FUTURE SCOPE

A. Conclusion

Following are the conclusion in the case of seismic analysis of G+ 6 framed structures with and without floating column and shear wall.

1) Use of floating column results in the increase of base shear, maximum moment, peak storey shear and percentage of steel reinforcement.
2) It is clearly shown that the use of a shear wall in the structure gives the best behaviour of the structure as compared with the normal building.
3) Providing a floating column is advantageous in terms of providing better space in structure but risky and vulnerability of the structure increases so, it is recommended that floating column should be provided with the shear wall in the centre location.
4) Optimum location of providing floating column is on the 6th floor where 4 columns are removed with shear wall in centre box type frame.

B. Scope for the Future

Few technical aspects might be considered for the future study to be presented, as given below.

1) The study can be carried out in the different location of the floating column and shear wall in all the seismic zone.
2) Study can be carried out in the different location of floating column and providing bracing, strut, in the building to minimise the effect of deflection and provide stability.

REFERENCES

[1] SK. Abdul Rehaman and M. Suresh Babu (2017) "SEISMIC ANALYSIS OF FRAMED STRUCTURES WITH AND WITHOUT FLOATING COLUMNS" International Journal of Civil Engineering and Technology (IJCIET) Volume 8, Issue 3, pp. 1070–1076.

[2] Sasidhar T, P. Sai Avinash and N. Janardan (2017) "ANALYSIS OF MULTISTORIED BUILDING WITH AND WITHOUT FLOATING COLUMN USING ETABS" International Journal of Civil Engineering and Technology (IJCIET) Volume 8, Issue 6, pp. 91–98.

[3] Israa H. Nayel, Shereen Q. Abdulridha and Zahraa M. Kadhum Babylon (2018) "THE EFFECT OF SHEAR WALL LOCATIONS IN RC MULTISTOREY BUILDING WITH FLOATING COLUMN SUBJECTED TO SEISMIC LOAD" International Journal of Civil Engineering and Technology (IJCIET) Volume 9, Issue 7, pp. 642–651.

[4] K Venkatesh and T. Venkatdas (2017) "STUDY ON SEISMIC EFFECT OF HIGH-RISE BUILDING SHEAR WALL/WALL WITHOUT SHEAR WALL" International Journal of Civil Engineering and Technology (IJCIET) Volume 8, Issue 1, pp 852-862.

[5] Kishalay Maitra and N. H. M. Kamrujjaman Serker (2018) "Evaluation of Seismic Performance of Floating Column Building". American Journal of Civil Engineering. Vol. 6, No. 2, 2018, pp. 55-59.

[6] Prof. Tejas N. Kothari, Prof. Pranay P. Deogade and Prof. Vishwajit R. Jaiswal (2019) "EXPERIMENTAL STUDY OF FLOATING COLUMN FOR SEISMIC ANALYSIS OF MULTISTOREY BUILDING" International Research Journal of Engineering and Technology (IRJET) Volume: 06 Issue: 10.

[7] Mr. Gaurav Pandey and Mr. Sagar Jamle (2018) "OPTIMUM LOCATION OF FLOATING COLUMN IN MULTISTOREY BUILDING WITH SEISMIC LOADING" International Research Journal of Engineering and Technology (IRJET) Volume: 05 Issue: 10.

[8] Y. R. Deshmukh, S. P. Jadhav, S. M. Shirsat, A. S. bankar andD. G. Rupanawar "A STUDY ON SIESMIC ANALYSIS OF MULTISTOREY BUILDING WITH FLOATING COLUMN USING STTAD.PRO.V8I." International Research Journal of Engineering and Technology (IRJET) Volume: 05 Issue: 5.

[9] kirankumar gaddad and vinayak vijapur (2018) "COMPARATIVE STUDY OF MULTI STOREY BUILDING WITH AND WITHOUT FLOATING COLUMNS AND SHEAR WALLS" International Research Journal of Engineering and Technology (IRJET) Volume: 05 Issue: 7.

[10] Shivam Wankhade and Prof. M. Shahezad (2019) "SEISMIC ANALYSIS OF MULTISTORY BUILDING WITH FLOATING COLUMN: A REVIEW" International Research Journal of Engineering and Technology (IRJET) Volume: 06 Issue: 12.

[11] Janardhan reddy, d. gose peera and t. anil kumar reddy (2015) "SIESMIC ANALYSIS OF MULTI-STORIED BUILDING WITH SHEAR WALL USING ETABS-2013" international journal of science and research (IJSR) volume 4 issue 11.

[12] Priya prasannan and ancy Mathew (2017) "Seismic Performance of RC Floating Column Considering Different Configurations" Vol. 6 Issue 05.

[13] Badgire Udhav S, Shaikh A.N. and Maske Ravi G. (2015) "Analysis of Multistorey Building with Floating Column" Volume No.4, Issue No.9, pp: 475-478.

[14] IS 875 (Part-I) Bureau of Indian Standards (1987) Code of Practice for Design Loads (Other than Earthquake) for Buildings and Structures: Dead Loads-Unit Weights of Building Materials and Stored Materials (Second Revision).

[15] IS 875 (Part-II) Bureau of Indian Standards (1987) Code of Practice for Design Loads For Buildings and Structures: Imposed Loads (Second Revision).

[16] IS 1893-1 (2000) criteria for earth quake resistance design of structures.

[17] IS 456-2000 for plain and reinforced concrete

[18] Duggal, S.K., Earthquake Resistant Design of Structures (Oxford University Press, 2007).

[19] Pankaj Agarwal, Manish Shrikhande, Earthquake Resistant design of Structures.