

# Effects of Floating Column on Regular RCC Structures under Seismic Forces Using STAAD-PRO V8i

Prof. Akshay Umare<sup>1</sup>, Prof. Sandhyarani M<sup>1</sup>, Rudrayya Godachannavar<sup>2</sup>, Surendra Shiraguppi<sup>2</sup>, Abhishek Khobannavar<sup>2</sup>, Abhishek Pawashe<sup>2</sup>

Assistant Professor, Department of Civil Engineering, S.G.Balekundri Institute of Technology, Belagavi, Karnataka, India<sup>1</sup>

U.G. Student, Department of Civil Engineering, S.G.Balekundri Institute of Technology, Belagavi, Karnataka, India<sup>2</sup>

**ABSTRACT:** As per the current scenario in civil engineering industry tall structures need to be constructed because of less space availability. This paper aims to contribute some important factors need to be considered in regular structure. When structure height increases, also the structure displacement increases and finally the member sizes will become very heavy which tends to provide less space for the premises. In this paper shear wall @ different places are used to control the displacement of structure and reduce the main member sizes so as to get more space. The structure is analysed under seismic force in zone III, the dimension of the structure is 25m (L) X 36m (B) X 33m (H). Shear wall @ Z direction, Shear wall @ X facing, Shear wall @ core, Shear wall @ corner and Shear wall @ intermediate is used for structure.

**KEYWORDS:** Regular structure, Shear wall, Base shear, Displacement, Storey drift, new model after conclusion.

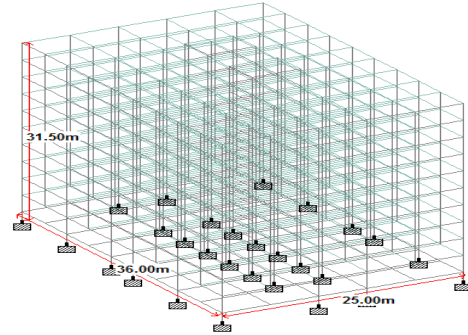
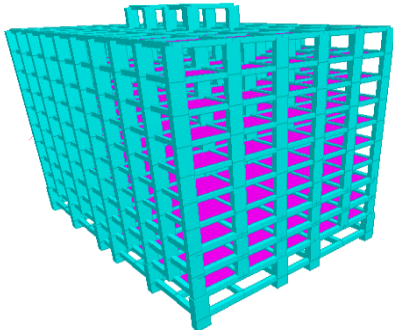
## I. INTRODUCTION

As a day today trend in India there are many multi-storey buildings urban zone have first storey open floor as an unavoidable feature whose primary use is as a parking or a reception lobbies during earthquake experienced by total base shear, which depends on natural time period and distribution of seismic force. But seismic force depends on stiffness and mass distribution of structure along its height.

During earthquake behaviour of the building depends on its geometry, shape, overall size and also how earthquake force is carried safely to the ground. During earthquake seismic force generate on different levels of structure, these forces should be brought down to the ground as a shortest path as possible along the building height. The building shows poor performance if there is a discontinuity or deviation in load transfer mechanism. In case of building with a vertical setback (like hotels with a few storeys which is wider compare to other buildings) causes sudden jump because of discontinuity in the seismic force distribution at different levels. And also building may collapse or damage due to fewer columns in a particular storey or in tall storey.

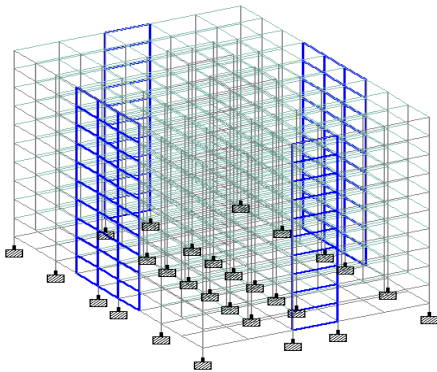
## II. MODELS FROM STAAD.PRO V8I SS6

### A. CONVENTIONAL BUILDING WITHOUT SHEAR WALL

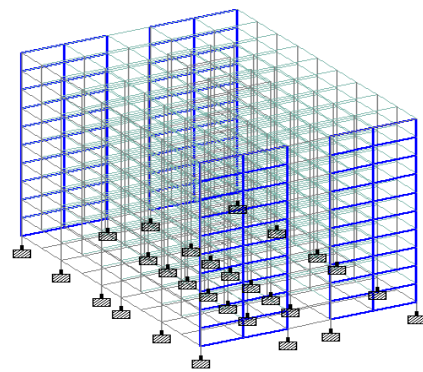


#### 1.1 Structural element Detail:

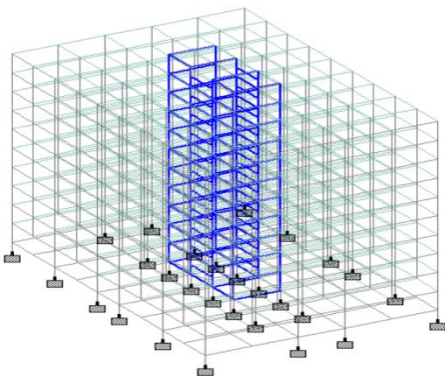
1. **Beam Size** : 500 X 800 mm
2. **Beam Size** : 300 X 550
3. **Column Size** : 500 X 1300 mm (Other than Basement)
4. **Column Size** : 800 X 1500 mm (Basement)
5. **Slab Thickness**: 150 mm
6. **Wall Thickness**: 230mm (Main Wall)



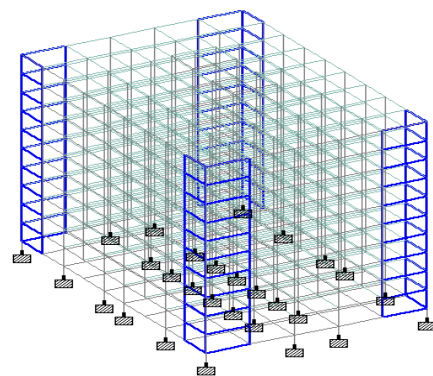
1. Shear Wall @ Z Direction



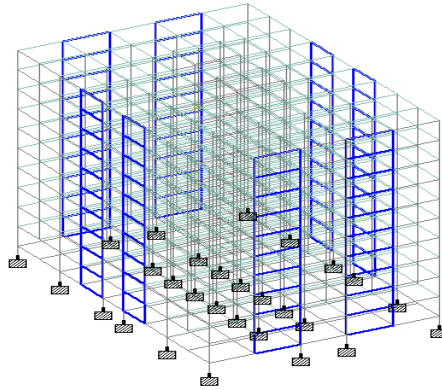
2. Shear wall @ X Facing



3. Shear Wall @ core



4. Shear wall @ Corner

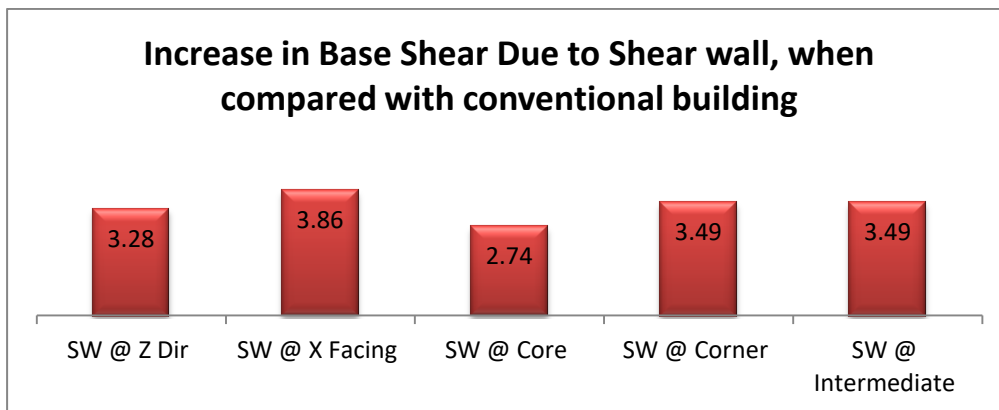


**3. Shear Wall @ Intermediate**

**III. EXPERIMENTAL RESULTS**

III.1 Comparison of Base shears of all models with Conventional Building:

Increase in Base Shear Due to Shear wall @ Different places, when compared with conventional building.		
Sl.No	Type of Building	% Increase
1	Shear Wall @ Z Direction	3.28
2	Shear Wall @ X Facing	3.86
3	Shear Wall @ Core	2.74
4	Shear Wall @ Corner	3.49
5	Shear Wall @ Intermediate	3.49



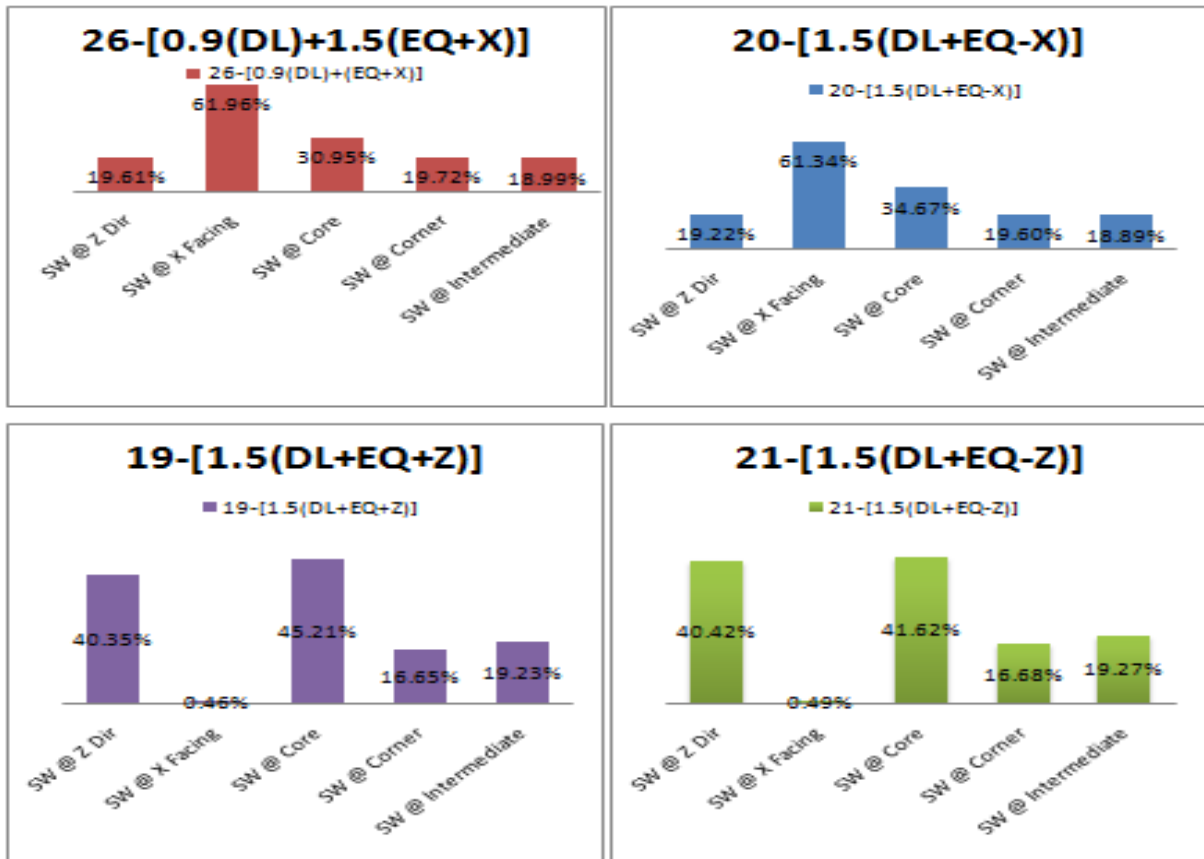
III.2 Below table shows displacement at top level of building i.e.; @ 33 m and compared with conventional building to check, which model is Suitable for this type of regular structure in all direction with maximum value in different load combination.



26-[0.9(D.L)+1.5(EQ+X)]	20-[1.5(DL+EQ-X)]	19-[1.5(DL+EQ+Z)]	21-[1.5(DL+EQ-Z)]
<b>Conventional Building Displacement at top level (@ 33 m Height)</b>			
73.306	73.528	80.611	80.214
<b>Shear wall @ Z Direction Displacement at top level (@ 33 m Height)</b>			
58.933	59.395	48.086	47.795
<b>Shear wall @ X Facing Displacement at top level (@ 33 m Height)</b>			
27.883	28.428	80.241	79.823
<b>Shear wall @ Core Displacement at top level (@ 33 m Height)</b>			
50.616	48.034	44.167	46.825
<b>Shear wall @ Corner Displacement at top level (@ 33 m Height)</b>			
58.853	59.12	67.187	66.834
<b>Shear wall @ Intermediate Displacement at top level (@ 33 m Height)</b>			
59.385	59.639	65.112	64.756

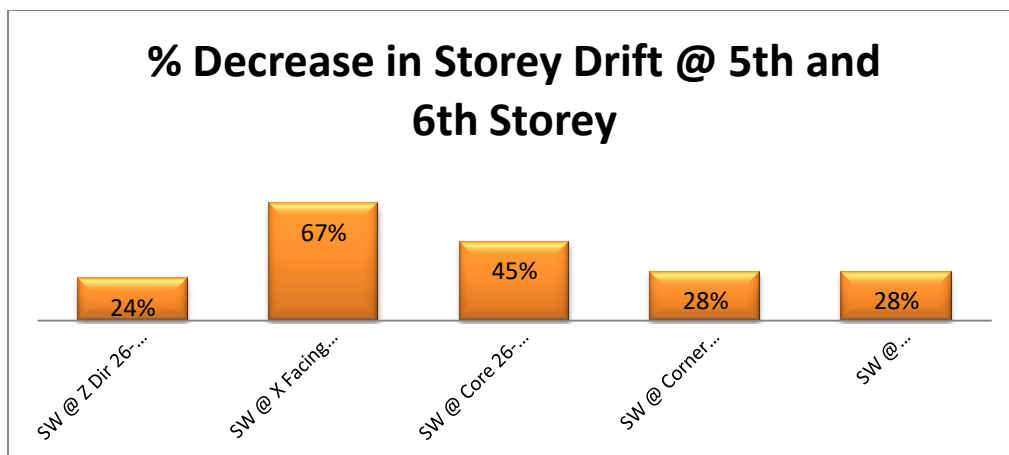
Below table shows the % Decreased Displacement at top level of building compared to Conventional Building

26-[0.9(D.L)+1.5(EQ+X)]	20-[1.5(DL+EQ-X)]	19-[1.5(DL+EQ+Z)]	21-[1.5(DL+EQ-Z)]
<b>Conventional Building Displacement at top level (@ 33 m Height)</b>			
73.306	73.528	80.611	80.214
<b>Shear wall @ Z Direction Displacement at top level (@ 33 m Height)</b>			
58.933	59.395	48.086	47.795
<b>Shear wall @ X Facing Displacement at top level (@ 33 m Height)</b>			
27.883	28.428	80.241	79.823
<b>Shear wall @ Core Displacement at top level (@ 33 m Height)</b>			
50.616	48.034	44.167	46.825
<b>Shear wall @ Corner Displacement at top level (@ 33 m Height)</b>			
58.853	59.12	67.187	66.834
<b>Shear wall @ Intermediate Displacement at top level (@ 33 m Height)</b>			
59.385	59.639	65.112	64.756



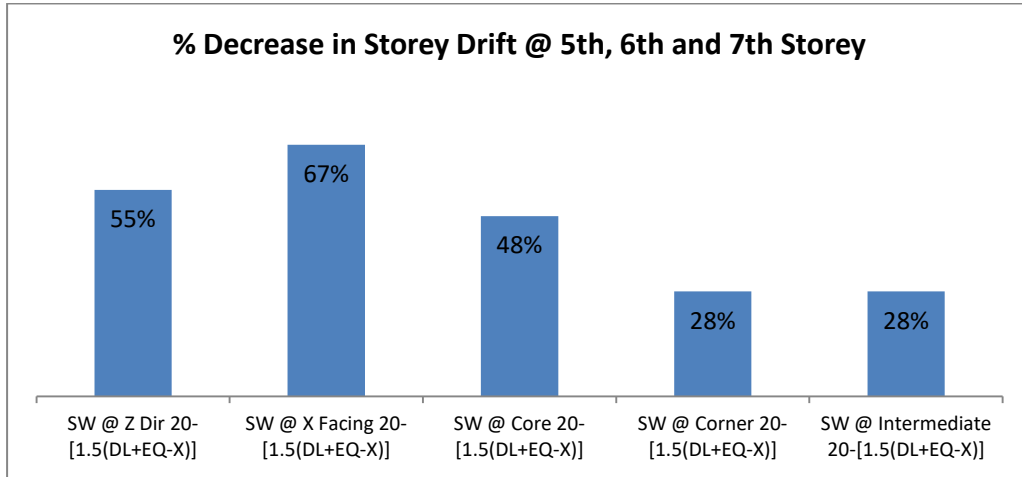
III.3 shows the % Decreased Storey drift at Different level of building Compared to Conventional Building.

1. Graph below Shows % Decrease Storey drift of all models for load combination 26 (+X)

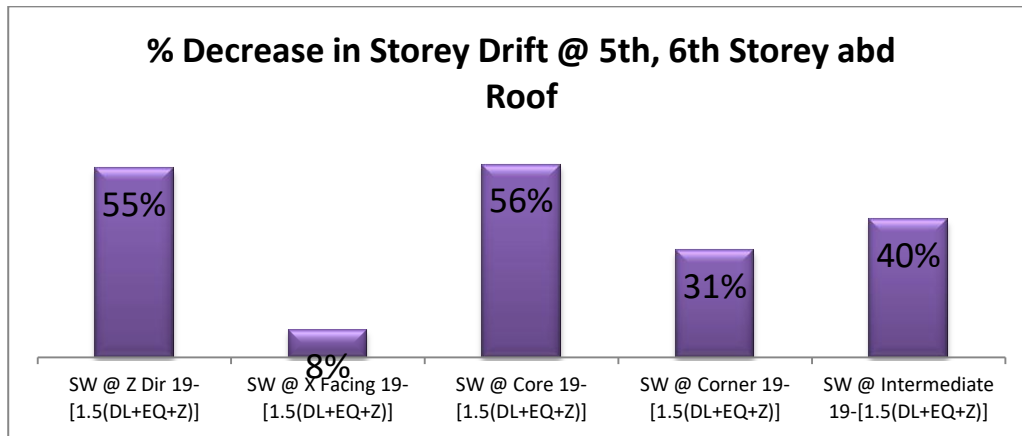




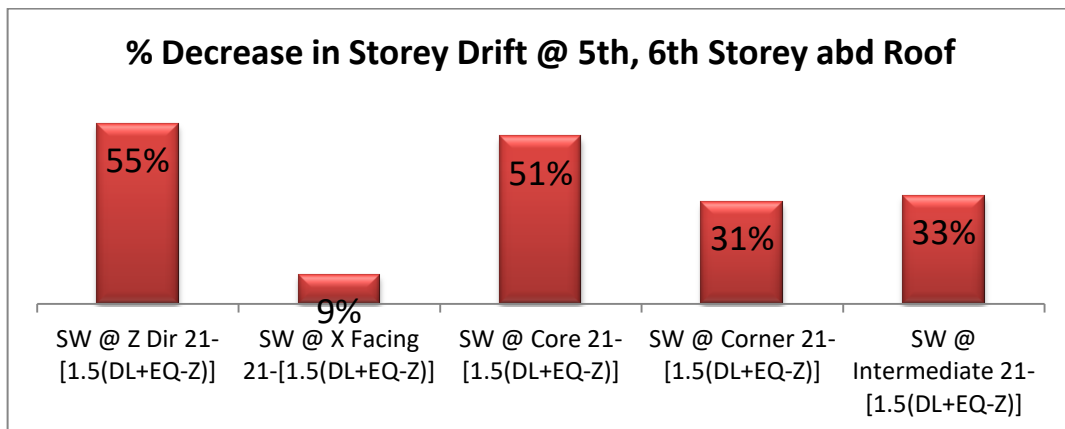
2. Graph below Shows % Decrease Storey drift of all models for load combination 20 (-X)



3. Graph below shows % Decrease Storey drift all models for load combination 19 (+Z)



4. Graph below shows % Decrease Storey drift all models for load combination 21 (-Z)



#### IV. CONCLUSION

##### IV.1 After observing the results from all the models following can be concluded which are as follows:

1. Shear wall @ core is giving highest result in +X & -X direction i.e.; 30.95% (+X) & 34.67% (-X) for displacement.
2. Shear wall @ core giving highest result in +Z & -Z direction i.e.; 45.21% (+Z) & 41.62% (-Z) for displacement.
3. As per the above two conclusion 1 & 2, Shear wall @ core is best suited for this type of structure when displacement is considered.
4. Highest increased base shear in Shear wall @ X facing is i.e.; 3.86% but it will get reduced when the remodelling of structure done with suitable SW and for this model best suited system is SW @ Core as mentioned in point 3.
5. Maximum % Decrease storey drift compare to conventional structure in SW @ X Facing (67%) in **26-[10.9(D.L)+0.9(EQ+X)]** @ 5<sup>th</sup> and 6<sup>th</sup> Storey; SW @ X Facing (67%) in **20-[1.5(DL+EQ-X)]** @ 5<sup>th</sup> & 6<sup>th</sup> Storey; SW @ Core (56%) in **19-[1.5(DL+EQ+Z)]** @ 5<sup>th</sup> and 6<sup>th</sup> Storey; SW @ Z Direction (55%) **21-[1.5(DL+EQ-Z)]** @ 5<sup>th</sup> and 6<sup>th</sup> Storey.
6. **Note: This type of structure gives good aesthetic look and space for showroom and theaters, so as per our project result SW @ Core is recommended so as to provide clear opening in walls which is giving highest results compared to other models.**

##### IV.2 After conclusion the model is revised by taking shear wall @ core the % decrease in concrete and steel are as follows:

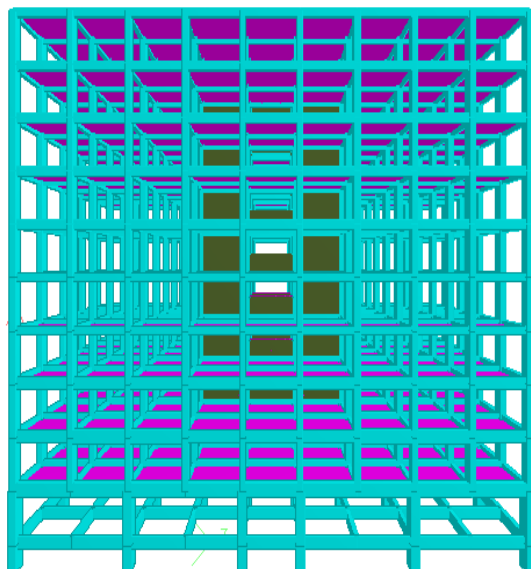
Conventional structure with shear wall @ core after conclusion. The sizes of member are as follows:

- **Beam Size :** 300 X 500 mm
- **Beam Size :** 300 X 700 mm
- **Beam Size :** 500 X 800 mm
- **Column Size :** 600 X 1200 mm
- **Column Size :** 400 X 1000 mm
- **Column Size :** 800 X 1500 mm
- **Slab Thickness:** 150 mm
- **Shear wall:** 250 mm Thick.
- **Wall Thickness:** 230mm (Main Wall)

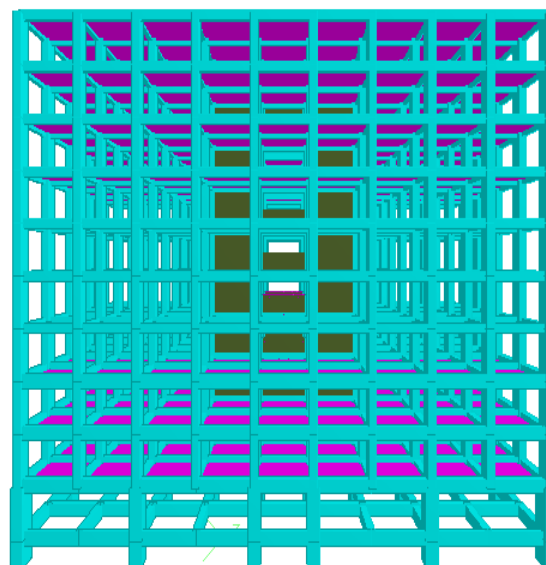
##### IV.3 Conclusion after revised model:

- ✓ % Decreased in Concrete = 33.87 %
- ✓ % Decreased in Steel = 13.99%
- ✓ Base shear is decreased by  $((15039.40-13517.92)/ 15039.40)$  10.12 % compared with SW @ core and SW @ core after remodelling of structure.

After Remodelling



After Conclusion



Observe the member sizes in above image for difference

#### REFERENCES

- [1] "Earthquake-Resistant Design of Building Structures" by Dr. VinodHosur Professor, Department of Civil Engineering Gogte Institute of Technology, Belgaum, Karnataka.
- [2] "Earthquake-Resistant Design of Building Structures" by Dr. VinodHosur Professor, Department of Civil Engineering Gogte Institute of Technology, Belagavi, Karnataka.
- [3] A Study on Seismic Analysis of Multi-storey Building with Floating Column Using Staad.ProV8i (Prof. Y. R. Deshmukh, S. P. Jadhav, S. M. Shirsat, A. S. Bankar, D. G. Rupanawar)
- [4] A study on Seismic analysis of multi-storey building with floating column ShivamWankhade, Prof. M. Shahezad
- [5] Optimum location of floating column in multistorey building with seismic loading Mr. GauravPandey, Mr. SagarJamle
- [6] Comparative Study of floating column of multi storey building by using software Ms. Waykule .S.B, Dr.C.P.Pise, Mr. C.M. Deshmukh, Mr.Y.P. Pawar, Mr S .S Kadam,Mr.D .D .Mohite,Ms.S.V. Lale
- [7] Experimental study of floating column for seismic analysis of multi-storey building Prof. Tejas N. Kothari, Prof. Pranay P. Deogade, Prof. Vishwajit R. Jaiswal
- [8] A comparative study on seismic resistance of a high rise structure with floating columns having infill shear wall at different locations. SD. NizamuddinKhadri, K.Pavan Kumar , A.S.V.Nagaraju
- [9] Seismic Response of Multistory Building for Discontinuity in Columns Altaf Husain, Dr.Kailash Narayan PG Student (M.Tech. Structural Engg.)
- [10] Study of floating column and non-floating column with and without earthquake Prof. Rupali. Goud
- [11] Optimum location of floating column in multistorey building with seismic loading Mr. GauravPandey, Mr. SagarJamle
- [12] Comparative Study of floating column of multi storey building by using software Ms. Waykule .S.B, Dr.C.P.Pise, Mr. C.M. Deshmukh, Mr.Y.P. Pawar, Mr S .S Kadam,Mr.D .D .Mohite,Ms.S.V. Lale
- [13] Behavior of B+G+9 Tall RCC Irregular Stepped Type Structure with Floating Column Using the Bracing and Shear Wall System under Seismic Forces Prof. Akshay Umare, Tejaswini Kittur, Divya Kurbet, Kasturi Biradar
- [14] Analysis of G+25 RCC Structure with shear wall under the effect of seismic loads using STAAD Pro V8i, Submitted by Akshay Umare et.al, from S.G.B.I.T Belagavi



### BIOGRAPHY



Prof. Akshay Umare is working as Assistant Professor, Dept. of Civil Engineering in S.G.Balekundri Institute of Technology, Belagavi-590010, Karnataka India



Prof. Sandhyarani M is working as Assistant Professor, Dept. of Civil Engineering in S.G.Balekundri Institute of Technology, Belagavi-590010, Karnataka India



Rudrayya Godachannavar is B.E Student, Dept. of Civil Engineering in S.G.Balekundri Institute of Technology, Belagavi-590010, Karnataka India



Surendra Shiraguppi is B.E Student, Dept. of Civil Engineering in S.G.Balekundri Institute of Technology, Belagavi-590010, Karnataka India



Abhishek Khobannavar is B.E Student, Dept. of Civil Engineering in S.G.Balekundri Institute of Technology, Belagavi-590010, Karnataka India



Abhishek Pawashe is B.E Student, Dept. of Civil Engineering in S.G.Balekundri Institute of Technology, Belagavi-590010, Karnataka India