International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 06 Issue: 06 | June 2019 www.irjet.net p-ISSN: 2395-0072

EFFECT OF FLOATING COLUMN ON STRUCTRAL FRAMES DURING SEISMIC FORCES

Prof. MANASA VEENA[1], KIRAN POOJARI[2], APPASO DOLE[3], NITIN MIRAJE[4], HANAMANTH V[5]

[1]Assistant professor, Dept of Civil Engineering, SGBIT Belagavi, Karnataka, India
[2,3,4,5]UG Student, Dept of Civil Engineering, SGBIT Belagavi, Karnataka, India

---***---

Abstract – *Now a days floating columns are used in construction of multistory structures, With some irregularities like soft story and vertical irregularities such as floating columns are used for providing more space and as well as for aesthetic purpose also. It is little tough task to construct a multistory building with a floating column in seismically active areas chances of damage of such buildings are more. Equivalance static analysis and response spectrum method are used for analysis in this project considering & comparing the relations of storey shear, storey drift and storey displacement and compared them.This comparison between storey shear, storey drift and storey displacementint with Equivalance static analysis and response spectrum method are done by using software ETABS V15.*

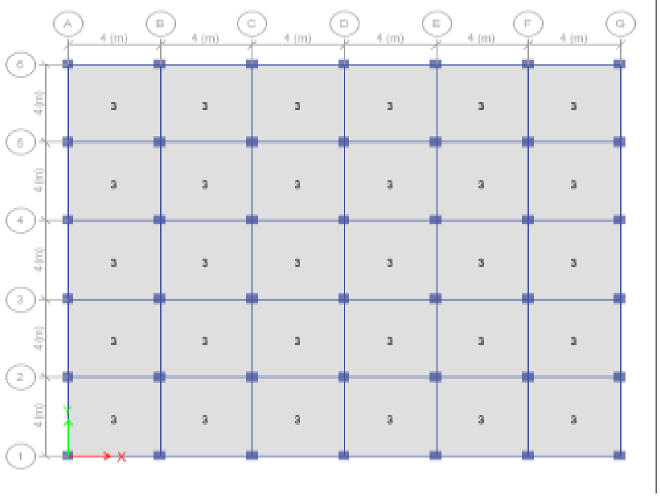
Key Words: Floating column, Equivalent static method, Response spectrum method, Storey shear, Storey drift, Storey displacement, seismic zone

1. INTRODUCTION

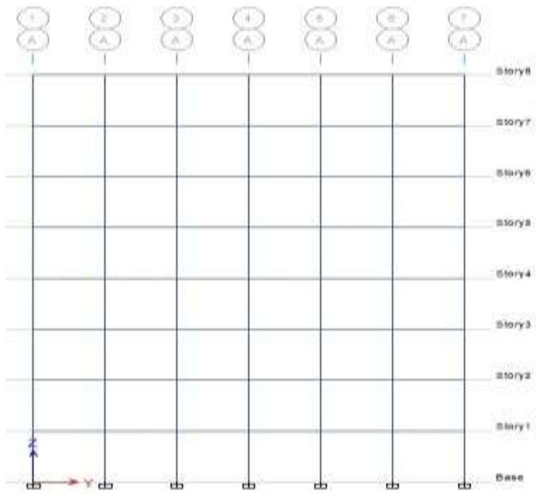
The column is a vertical structural member which transfers the structural load coming from slab and beam vertically to ground. Now days in India there is a trend of constructing multistory building with floating column for more commercial & for aesthetic appearence. Floating column is defined as it is vertical member which rest on a beam but doesn't transfer the load to the foundation. The beam is called transfer beam. It is very important to construct a structure to resist lateral force even with irregularities.

2. MODELING DETAILS.

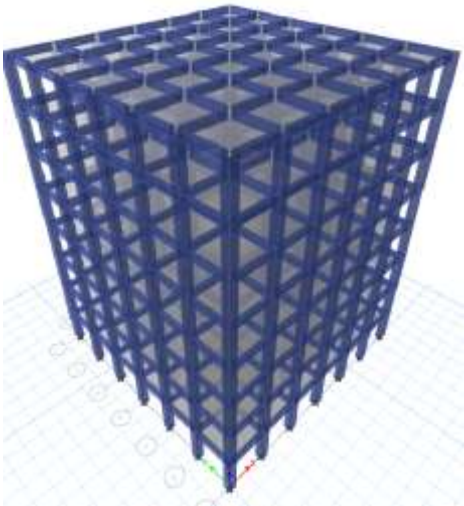
2.1 3m span 6 bay 8 storey regular model (RM)



PLAN

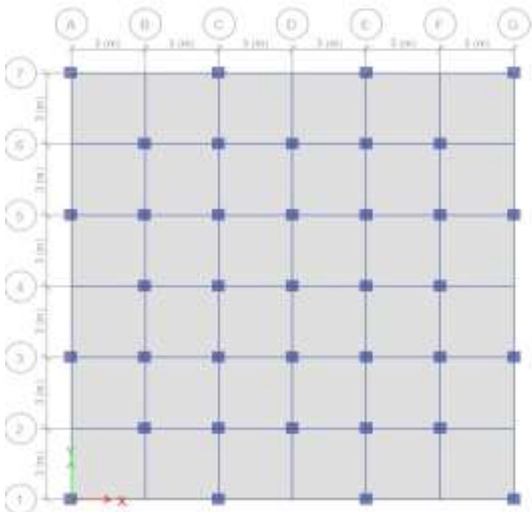


ELEVATION

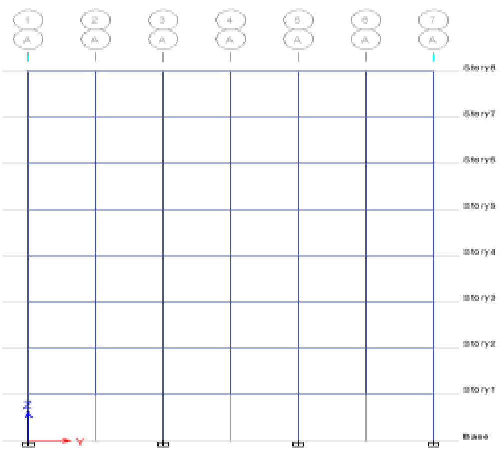


3D VIEW

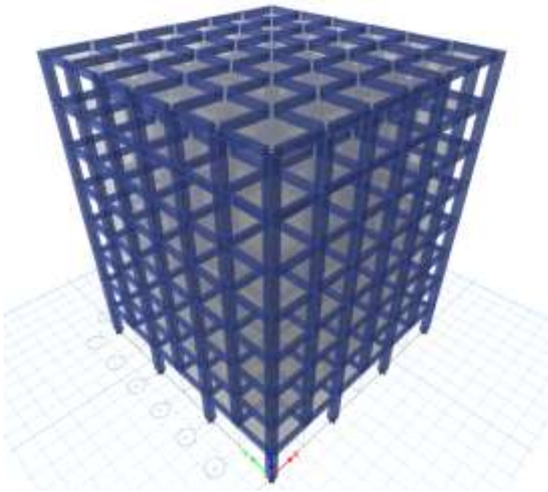
2.2 3m span 6 bay 8 storeys RM+FC at periphery



PLAN

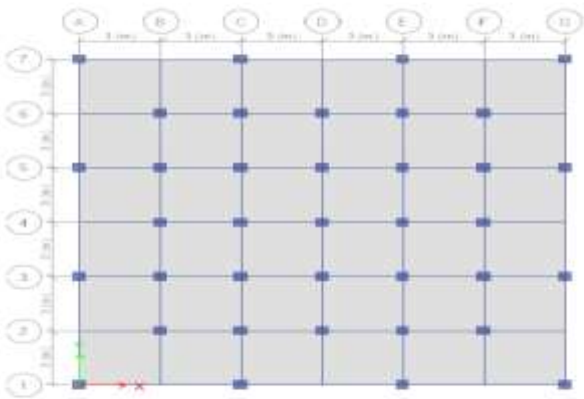


ELEVATION

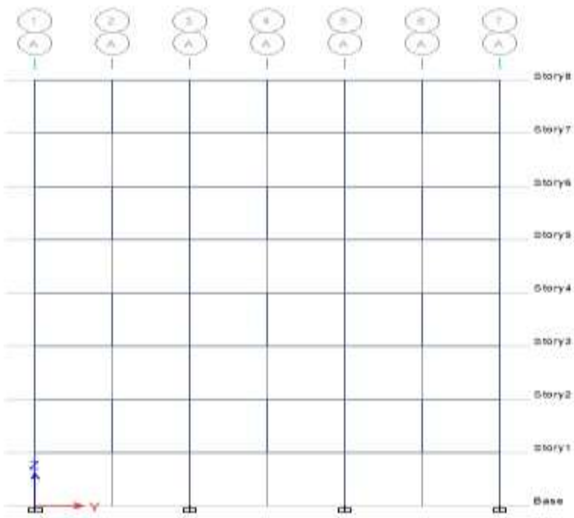


3D VIEW

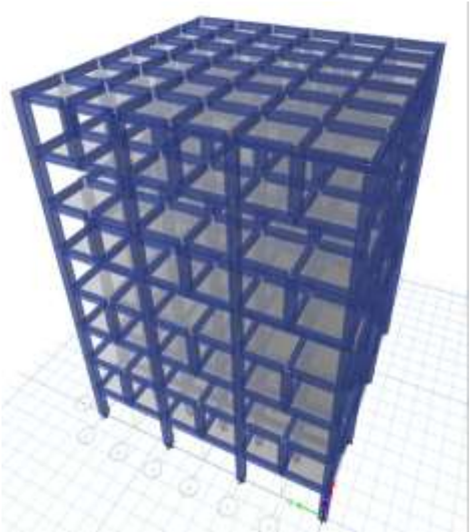
2.3 3m span 6 bay 8 storey RM+FC at periphery and alternate floors.



PLAN

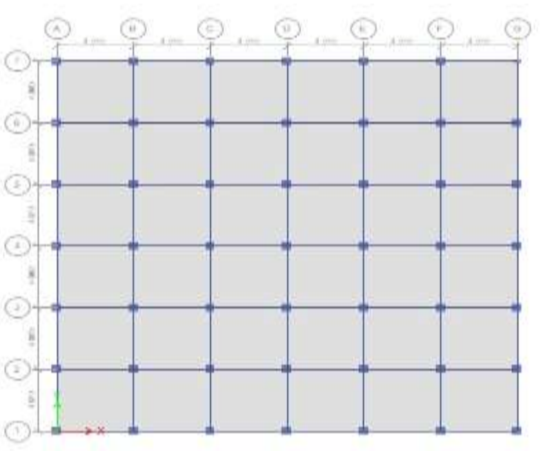


ELEVATION

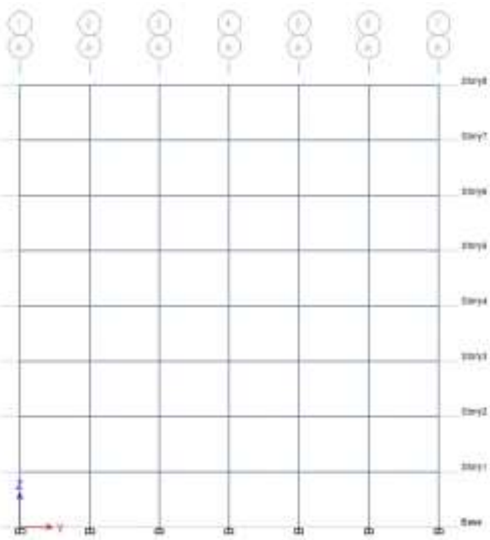


3D VIEW

2.4 4m span 6 bay 8 storey regular model (RM)



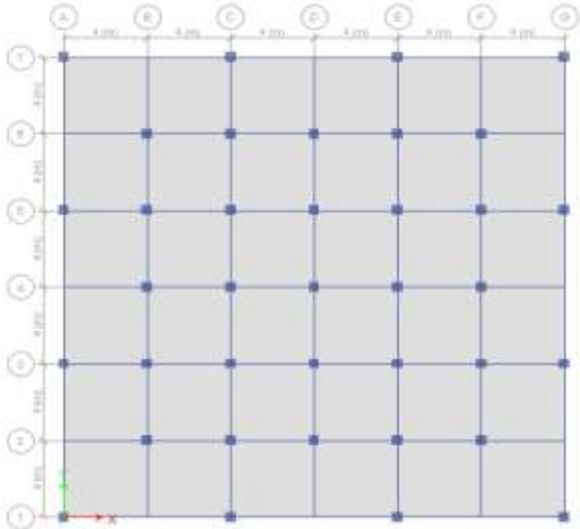
PLAN



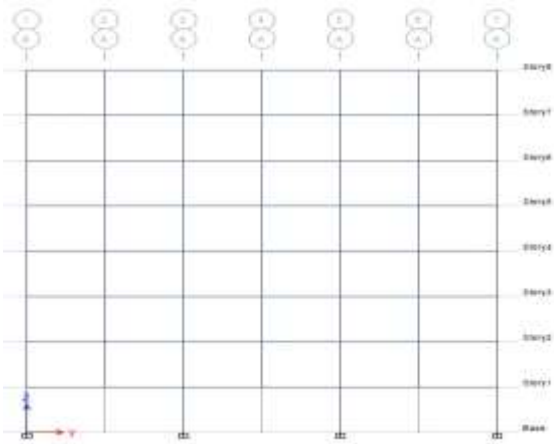
ELEVATION

3D VIEW

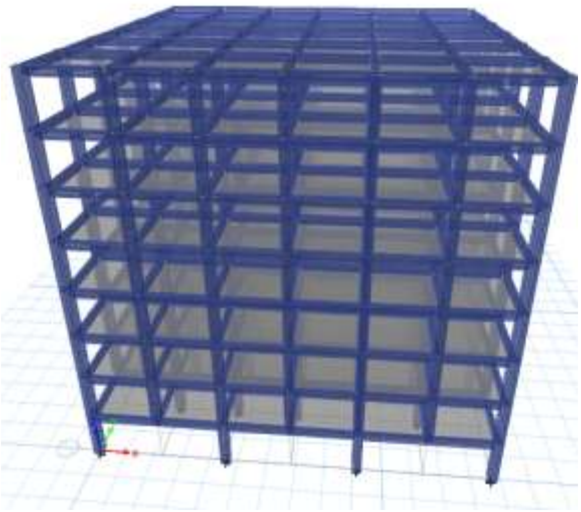
2.5 4m span 6 bay 8 storey RM+FC at periphery



PLAN

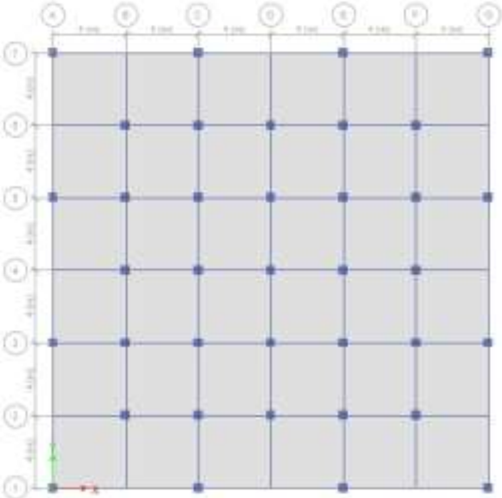


ELEVATION

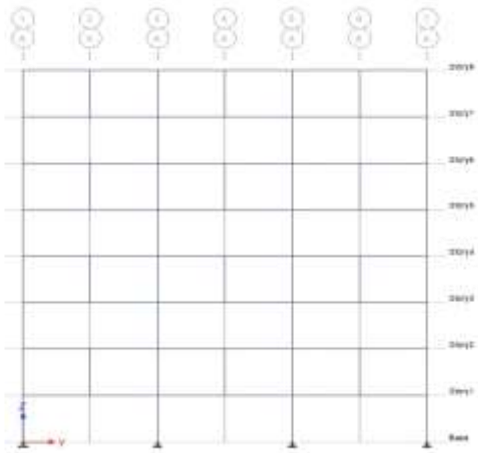


3D VIEW

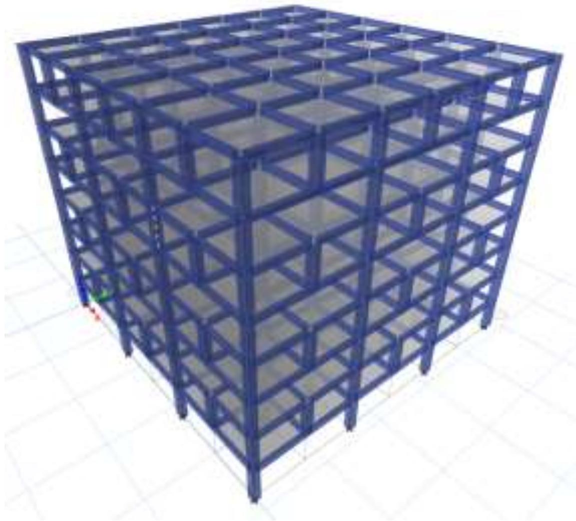
2.6 4m span 6 bay 8 storey RM+FC at periphery and alternate floors.



PLAN



ELEVATION



3D VIEW

3. ANALYSIS OF SELECTED MODELS

Dimensions of structural element:

1. Column size – 500mm X 500mm
2. Beam size – 230mm X 450mm
3. Slab thickness – 150mm

Specifications:

1. Earthquake Zone : 5
2. Type of Soil : Medium Type II
3. Structure Type SMRF : R =5
4. Importance Factor : I =1.5

Material properties:

1. M25 Weight/Unit Volume : 25 kN/mm^2
2. Modulus of elasticity E: 25000/mm^2
3. Poisson's Ratio, : 0.2
4. Shear modulus, G: 10416.67N/mm^2
5. Co-efficient of thermal expansion,

   A: $0.0000055^{0/C}$
6. F_{ck} = 25 N/mm^2
7. F_y = 415 N/mm^2

Loads:

1. Live load on Floor= 4kN/mm^2
2. Floor finish = 1.5kN/m^2
3. Live Load on Roof = 3kN/m^2
4. Floor finish on roof = 1.75k N/m^2

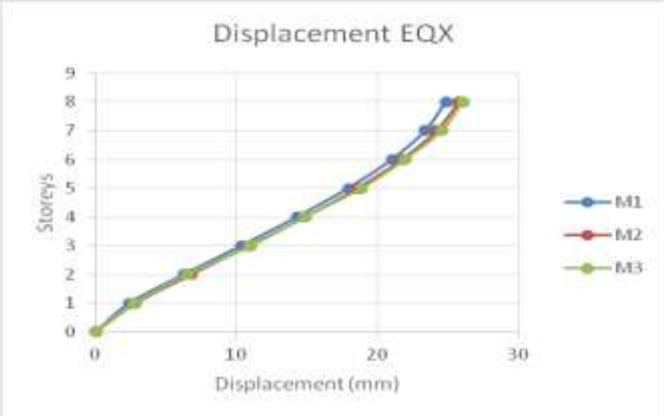
Following models are analyzed using E-Tabs 2015 software. The results obtained are discussed further

TABLE: Story Response displacement in X-direction			
Story	X-Dir	X-Dir	X-Dir
	M1	M2	M3
	mm	mm	mm
8	24.89	25.809	26.092
7	23.429	24.213	24.615
6	21.066	21.757	21.989
5	17.955	18.583	18.906
4	14.318	14.903	14.91
3	10.36	10.91	11.032
2	6.274	6.786	6.546
1	2.389	2.843	2.727
0	0	0	0

4.0 EQUIVALENT STATIC ANALYSIS

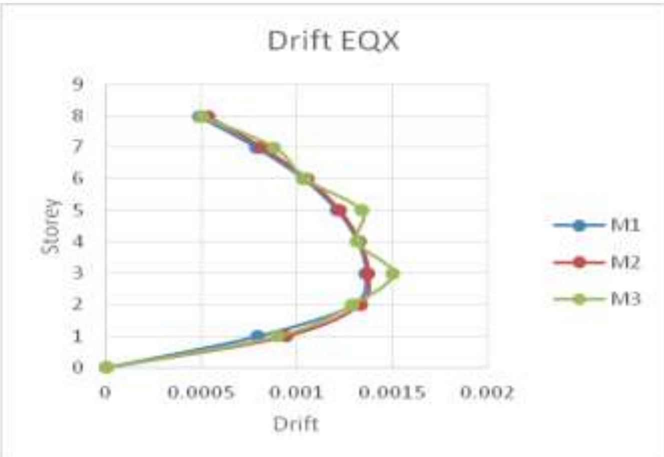
The equivalent static method is simplified technique to substute the effect of dynamic loading an of expected earthquake by a static force distributed laterally on a structure for design purpose the total applied seismic force V is generally evaluated into horizontal direction parallel to the main axes of the building. It assumes that building responds in its fundamental lateral mode. For this storey true, the building must be low rise and must be fairly symmetric to avoid torsional moment underground motions. The structure must be able to resist effects caused by seismic forces in either direction, but not in both direction simultaneously The equivalent static method is a simplest method of analysis and requires computational effort because the courses depend on the code based fundamental time period of structure with some empirical modifier.

4.1Storey displacement:



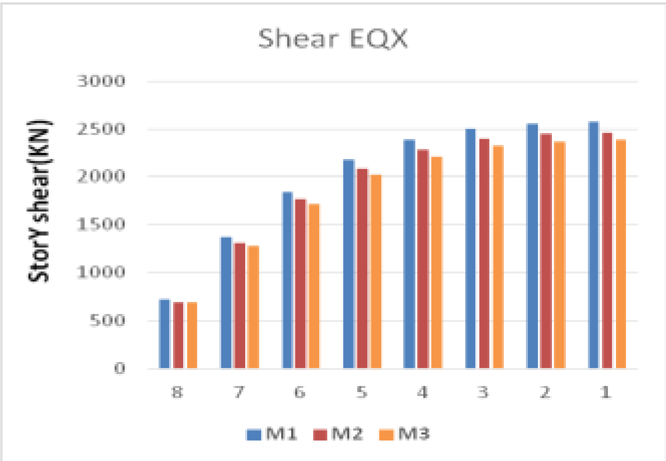
4.2Storey drift :

TABLE: Story Response: drift in X-direction			
Story	X-Dir	X-Dir	X-Dir
	M1	M2	M3
8	0.000488	0.000533	0.000501
7	0.000788	0.000819	0.000882
6	0.001037	0.001058	0.001045
5	0.001212	0.001227	0.00134
4	0.00132	0.001331	0.001314
3	0.001362	0.001377	0.001503
2	0.001298	0.001332	0.001292
1	0.000796	0.000943	0.000902
0	0	0	0



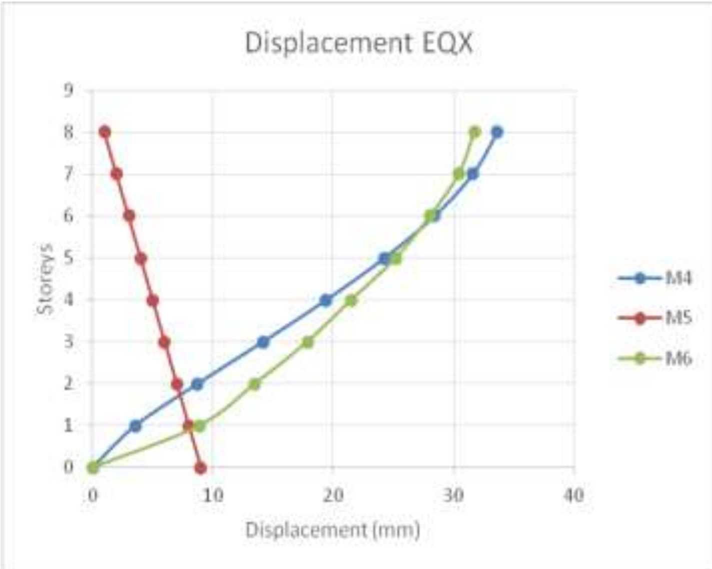
4.3 Storey shear:

TABLE: Story Response: shear in X-direction			
Story	X-Dir	X-Dir	X-Dir
	M1	M2	M3
	kN	kN	kN
8	725.8904	694.3821	687.0721
7	1371.2383	1311.7177	1281.4408
6	1845.3714	1765.2704	1714.9617
5	2174.6305	2080.2375	2018.2111
4	2385.3563	2281.8165	2210.887
3	2503.8896	2395.2047	2320.0568
2	2556.571	2445.5994	2368.2257
1	2569.7414	2457.8584	2380.3557



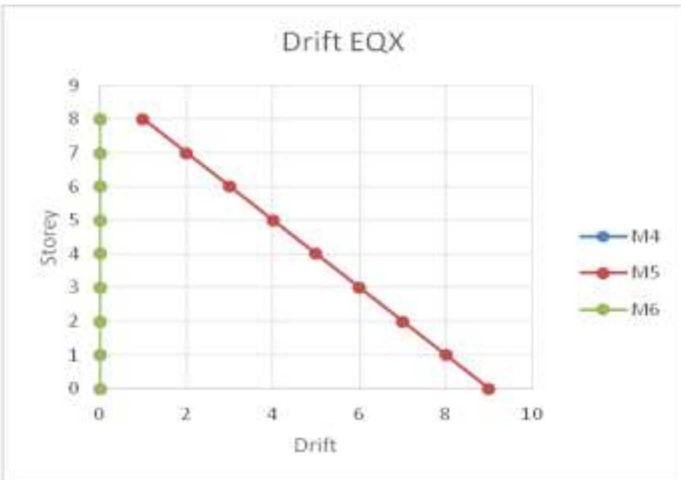
4.4Storey displacement results for M4, M5 & M6

TABLE: Story Response displacement in X-direction			
Story	X-Dir	X-Dir	X-Dir
	M4	M5	M6
	mm	mm	mm
8	31.759	33.662	35.021
7	30.45	31.606	33.452
6	28.066	28.414	30.905
5	25.222	24.265	27.537
4	21.512	19.433	23.578
3	17.85	14.171	19.212
2	13.497	8.731	14.505
1	9.001	3.562	9.001
0	0	0.0	0



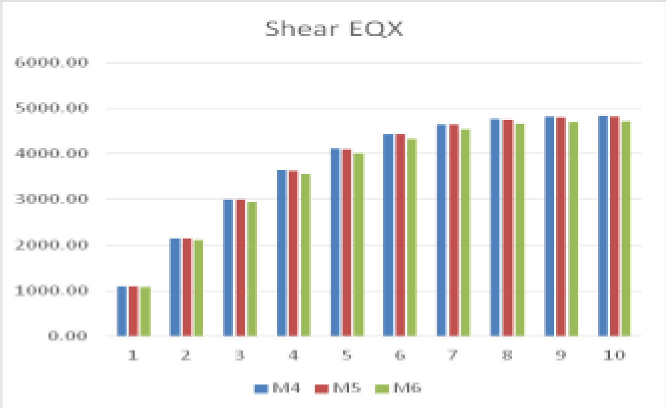
4.5Storey drift results for M4,M5 & M6

TABLE: Story Response: drift in X-direction			
Story	X-Dir	X-Dir	X-Dir
	M4	M5	M6
8	0.000524	0.000687	0.000443
7	0.000849	0.001064	0.000798
6	0.001122	0.001383	0.000961
5	0.00132	0.001611	0.001239
4	0.001455	0.001754	0.001238
3	0.001572	0.001816	0.001454
2	0.001843	0.001744	0.001562
1	0.003	0.00118	0.00295
0	0	0	0



4.6 Storey Shear results for M4,M5 & M6

TABLE: Story Response displacement in X-direction			
Story	X-Dir	X-Dir	X-Dir
	M1	M2	M3
	mm	mm	mm
8	19.7	20.3	20.6
7	19.2	19.8	20.1
6	18.1	18.0	18.7
5	15.9	16.3	16.7
4	13.1	13.5	13.7
3	9.8	10.2	10.3
2	6.0	6.5	6.6
1	2.3	2.8	2.6
0	0.0	0.0	0.0

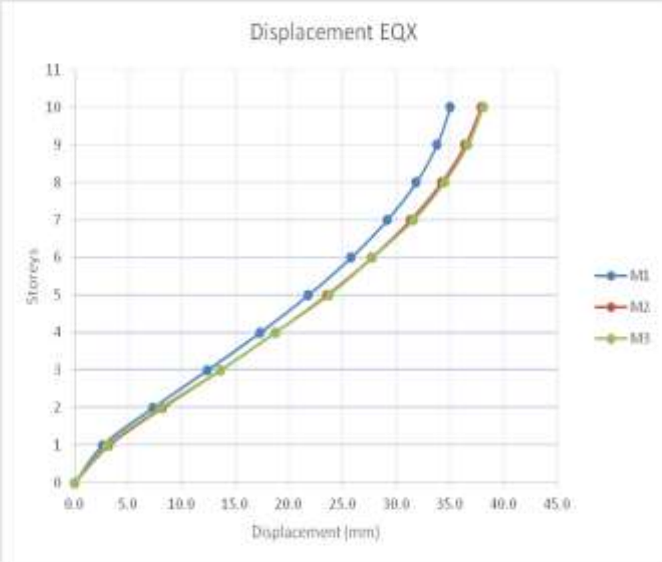


5.0 RESPONSE SPECTRUM METHOD :

It is not possible to have records at each and every location so we prefer Response spectrum method. Response of the structure depend upon the frequency content of ground motion and its own dynamic properties. To overcome the above difficulties, earthquake response spectrum is the most popular tool in seismic analysis of structures. There are computational advantages in using the response spectrum method of seismic analysis for prediction of displacements and member forces in structural systems.

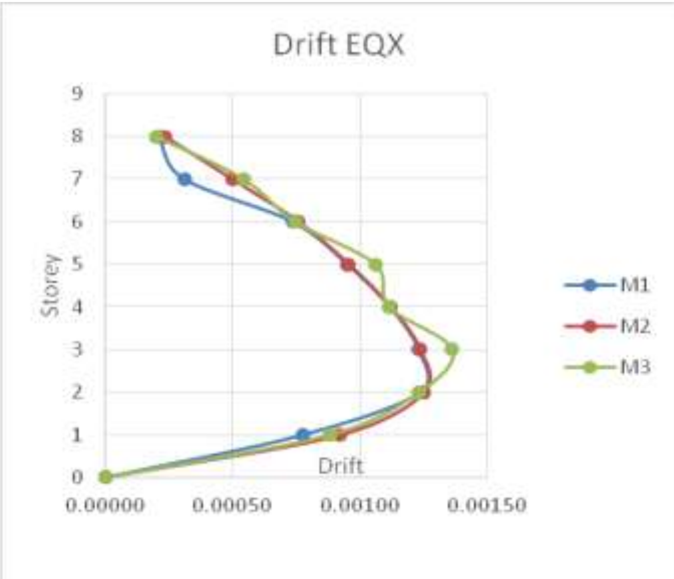
5.1 storey displacement:

TABLE: Story Response: shear in X-direction			
Story	X-Dir	X-Dir	X-Dir
	M4	M5	M6
	kN	kN	kN
1	1084.16	1081.59	1079.92
2	2147.36	2142.25	2113.54
3	2987.41	2980.31	2925.46
4	3630.58	3621.95	3550.73
5	4103.11	4093.36	4007.44
6	4431.26	4420.72	4326.45
7	4641.27	4630.24	4529.44
8	4759.41	4748.09	4644.28
9	4811.91	4800.47	4695.03
10	4825.04	4813.25	4707.79



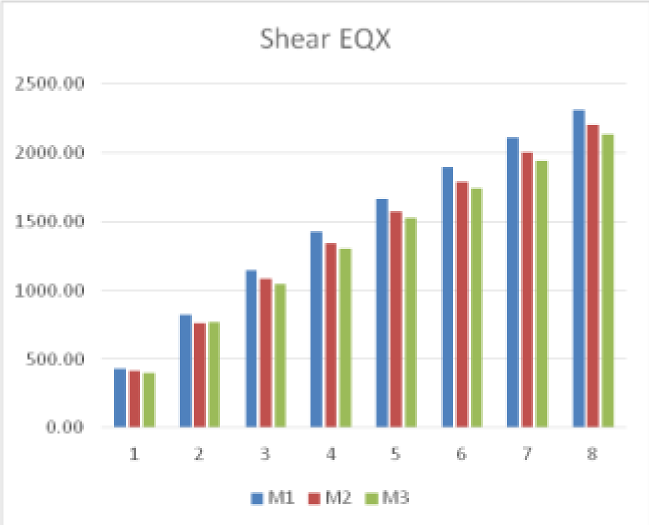
5.2 Storey drift:

TABLE: Story Response: drift in X-direction			
Story	X-Dir	X-Dir	X-Dir
	M1	M2	M3
8	0.00021	0.00023	0.00020
7	0.00031	0.00050	0.00054
6	0.00074	0.00076	0.00075
5	0.00095	0.00096	0.00106
4	0.00112	0.00112	0.00111
3	0.00123	0.00124	0.00136
2	0.00124	0.00125	0.00123
1	0.00078	0.00092	0.00088
0	0.00000	0.00000	0.00000



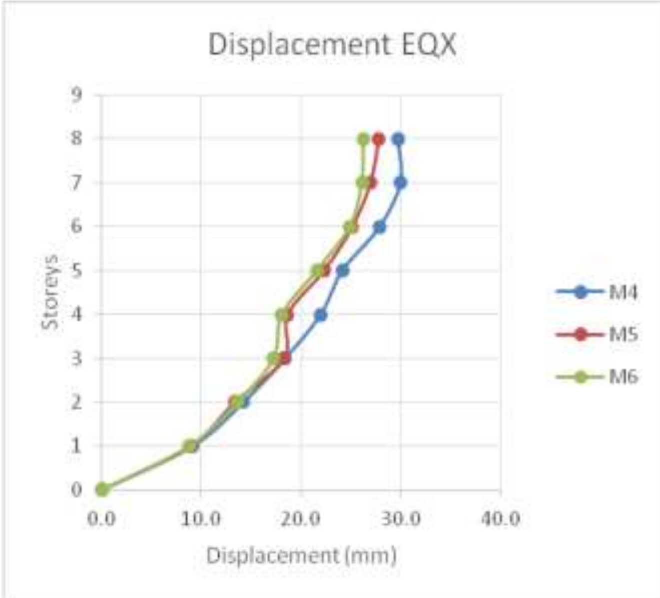
5.3: Storey shear:

TABLE: Story Response: shear in X-direction			
Story	X-Dir	X-Dir	X-Dir
	M1	M2	M3
	kN	kN	kN
1	432.41	412.96	402.71
2	825.20	758.54	768.07
3	1143.00	1082.20	1049.05
4	1420.23	1339.33	1301.68
5	1666.40	1568.44	1520.76
6	1896.22	1787.02	1736.70
7	2108.37	2001.64	1940.95
8	2307.21	2200.32	2134.74



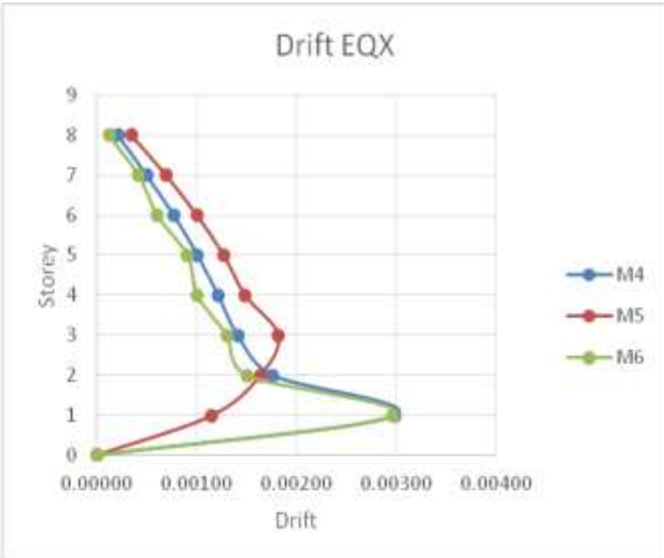
5.4Storey displacement results for M4, M5 & M6

TABLE: Story Response displacement in X-direction			
Story	X-Dir	X-Dir	X-Dir
	M4	M5	M6
	mm	mm	mm
8	26.2	27.8	29.7
7	26.1	26.9	30.0
6	24.9	25.1	27.9
5	21.6	22.3	24.1
4	18.1	18.6	22.0
3	17.2	18.3	18.4
2	13.6	13.3	14.2
1	8.8	8.9	9.1
0	0.0	0.0	0.0



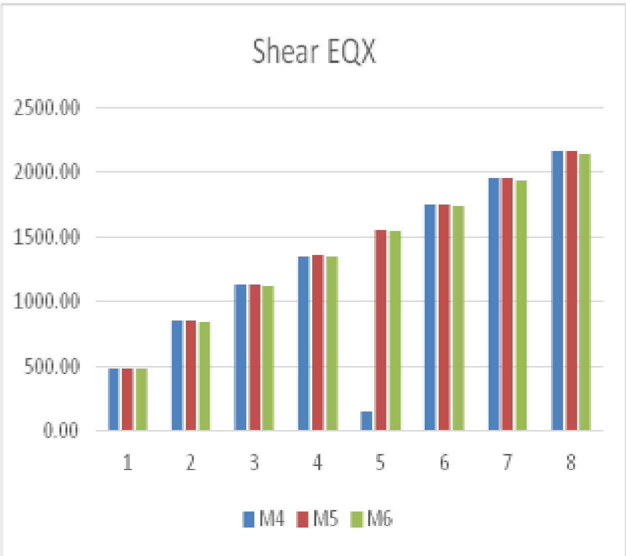
5.5 Storey drift results for M4, M5 & M6

TABLE: Story Response: drift in X-direction			
Story	X-Dir	X-Dir	X-Dir
	M4	M5	M6
8	0.00021	0.00035	0.00012
7	0.00050	0.00069	0.00042
6	0.00077	0.00100	0.00061
5	0.00101	0.00127	0.00091
4	0.00122	0.00148	0.00101
3	0.00141	0.00182	0.00130
2	0.00176	0.00163	0.00150
1	0.00298	0.00115	0.00296
0	0.00000	0.00000	0.00000



5.6 Storey Shear results for M4,M5 & M6

TABLE: Story Response: shear in X-direction			
Story	X-Dir	X-Dir	X-Dir
	M4	M5	M6
	kN	kN	kN
1	483.96	479.82	478.28
2	854.51	849.25	845.86
3	1125.44	1126.86	1122.98
4	1352.12	1354.46	1345.64
5	155.04	1550.18	1546.69
6	1752.17	1748.63	1740.34
7	1960.92	1953.29	1936.92
8	2164.29	2162.29	2142.22



6. CONCLUSIONS

1 .Displacement in M1 is observed minimum where as Deflection in M3 & M6 is observed maximum& More Displacement is observed in M4,M5,M6 compared to all other models because of increase in bay size.
2. 28% more deflection is found in M6 EQSM than RSM
3. Storey drift in M6 is observed maximum with compare to all other models
4. reduction of 26% Storey drift is observed in M6 when Compare to M1
5. Storey shear in M1 is observed maximum compare to all other models
6. Storey shear is observed 21% reduction in M6 than M1

REFERENCES

- Sudhir K Arlekar Jaswant. and Murty C.V.R, (1997), "Seismic Response of RC Frame Buildings with Soft First Storeys". Proceedings of the CBRI Golden Jubilee Conference on Natural Hazards in Urban Habitat, 1997, New Delhi.
- Mr. P.V. Prasad &T.Raja Sekhar, "Study Of Behavior Of Seismic Analysis Of Multi Storied Building With And Without Floating Column", Caribbean Journal of Science and Technology, 2014, Vol 2,Page 697-710
- Nikhil Bandwall & Anant Pande, "To Study Seismic Behavior of RC Building with Floating Columns", International journal of scientific engineering and technology and research. ISSN 2319-8885 Vol.03, Issue.08, May-2014, Pages: 1593-1596.
- Mohd.Azaz, Amarnath.D.B, Mohd.yasin sheikh & L.Quazi, "An analysis of multi-storey building with floating and non floating column under seismic loading in different zones", International Research Journal of Engineering and Technology (IRJET) Volume:04 Issue:02|feb-2017.
- Mr.Veeresh Hiremath and Masana veena "Seismic beheviour of multi storey building with and without floating column. International Research Journal of Engineering and Technology (IRJET) Feb- 2018

BIOGRAPHIES

Mrs.MANASA VEENA
Asst.PROF.CIVIL ENGINEERING DEPARTMENT,SGBIT, BELAGAVI KARNATAKA INDIA

Mr. KIRAN POOJARI
STUDENT OF CIVIL ENGINEERING
SGBIT BELAGAVI
KARNATAKA INDIA

Mr. APPASO DOLE
STUDENT OF CIVIL ENGINEERING,
SGBIT BELAGAVI
KARNATAKA INDIA

Mr. NITIN MIRAJE
STUDENT OF CIVIL ENGINEERING,
SGBIT BELAGAVI
KARNATAKA INDIA

Mr. HANAMANT VAJRAWAD
STUDENT OF CIVIL ENGINEERING,
SGBIT BELAGAVI
KARNATAKA INDIA