BEHAVIOR OF SYMMETRIC AND ASYMMETRIC STRUCTURE IN HIGH SEISMIC ZONE

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ABSTRACT: Buildings can be taken into consideration as uneven in plan or in elevation based totally on the distribution of mass and stiffness alongside every storey, during the height of the homes. Most of the hilly regions of India are tremendously seismic. A building on hill slope differs in unique way from different homes. In this have a look at, 3-D analytical model of 4 and 9 storied buildings had been generated for symmetric and uneven building models and analyzed the use of structural evaluation tool "SAP2000 Nonlinear". To have a look at the effect of varying height of columns in ground storey due to sloping floor, the plan format is kept similar for both homes on plane and sloping ground. The analytical version of the building includes all essential components that have an impact on the mass, energy, stiffness and deformability of the structure. To take a look at the effect of infill at some point of earthquake, seismic evaluation using dynamic evaluation is finished.

Keywords: Symmetric Structure, Asymmetric Structure, SAP 2000, vertical geometric irregular

INTRODUCTION

Today is the era of Performance Based Engineering philosophies in seismic design of Civil Engineering structures. Qualitative seismic design provisions require Structural Engineers to carry out each static and dynamic analysis for the layout of structures. However, for the reason that seismic prediction continues to be far from becoming a reality however, it is very vital to alter the prediction of the seismic Conduct of present structures. This is the purpose why research of Seismic Vulnerability of Buildings had been developed to evaluate the expected damage in the distinctive forms of buildings. At gift people are facing problems of land scarcity, price of land. The populace explosion and introduction of commercial revolution led to the exodus of people from villages to urban areas i.e. Production of multi-storied homes has come to be inevitable each for residential and in addition to office functions. The excessive raised structures aren't nicely designed for the resistance of lateral forces. It may additionally motive to the entire failure of the structures. The earthquake resistance systems are designed based totally at the a few factors. The elements are natural frequency of the structure, damping issue, sort of foundation, importance of the building and ductility of the shape

Dynamic movements are triggered on homes by means of each wind and earthquakes. But, layout for wind forces and for earthquake outcomes is fairly special. The intuitive philosophy of structural layout makes use of pressure as the premise, that's consistent in wind layout, wherein the building is subjected to a pressure on its exposed floor location; that is force-type loading. However, in earthquake design, the constructing is subjected to random motion of the floor at its base which induces inertia forces in the building that in flip reason stresses; this is displacement-type loading. Another manner of expressing this difference is through the load-deformation curve of the constructing the call for at the constructing is pressure (i.e., vertical axis) in force-type loading imposed by wind strain, and displacement (i.e., horizontal axis) in displacement-type loading imposed via earthquake shaking. Wind force on the building has a non-0 suggest issue superposed with a highly small oscillating thing (Figure 1.2).

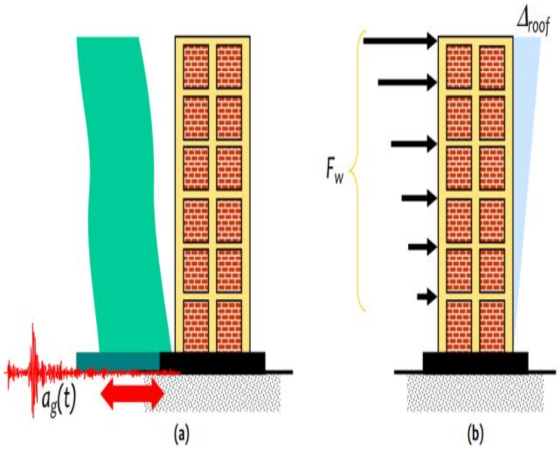


Figure 1: Difference in the design effects on a building during natural actions of

(a) Earthquake *Ground Movement* at base, and (b) Wind *Pressure* on exposed area

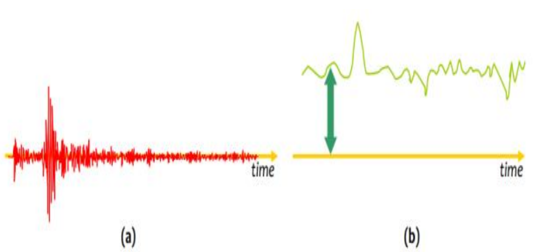
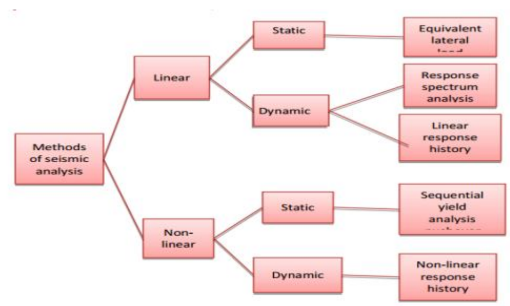


Figure 1.2: *Nature of temporal variations of design actions*: (a) Earthquake Ground Motion – zero mean, cyclic, and (b) Wind Pressure – non-zero mean, oscillatory

OBJECTIVE OF STUDY:

1. To study the effect of time period and frequency for symmetric and asymmetric multi-storied R.C.building in high seismic zone.
2. To study the response base reactions and element forces for analysis of symmetric and asymmetric
3. To compare the response parameters such as joint reactions, element forces, base reactions, section cut forces of Symmetrical and conventional building.

METHOD OF ANALYSIS



Response Spectrum method, being time consuming and tedious process, most of time, it resort to computer applications. Now while, modeling the structure, in most of available software's, usually, we model the space frame, neglecting the in-fill wall stiffness. These results in flexible frames, and due to which, in most of Cases, the program gives a higher Time Period and results into lower base shear.

Today with the availability of Powerful Computers and Software, the seismic coefficient method should not be applied to anything other than mass concrete!! In such a case a reduction coefficient would not be applicable. The infill walls and slabs should be modeled. If software has plate modeling capability, these can be modeled as plates. Otherwise an "equivalent" pair of diagonal members connecting the four corners of the slab or wall (in each bay) would simulate the shear behavior The diagonal members shall be 'truss' members - i.e. capable of only carrying axial load. The elastic properties can be derived from first principle, by matching forces and deformations in a plate and the equivalent diagonals

LITERLATURE REVIEW

Dr. S.N.Tande, S.J. Patil et al.,(2013) Presented "Seismic Response of Asymmetric Buildings" In this paper Structural asymmetry can be a major reason for buildings poor performance under severe seismic loading, asymmetry contributes significantly to the potential for translational-tensional coupling in the structures dynamic behavior which can lead to increased lateral deflections, increased member forces and ultimately the buildings collapse. In this paper the inelastic seismic behavior and design of asymmetric multistoried buildings are studied. The effects of torsion on buildings are investigated. The buildings with setbacks are analyzed for torsion. Study also shows that there is increase in shear, in columns and the columns at outer frame need some special attention.

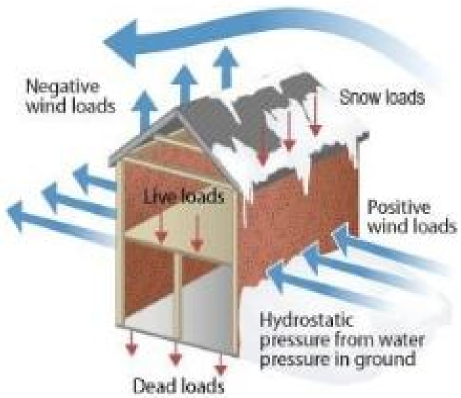
Undareson A, Ganesh Baravkar, Vijaya Sarathy R Presented "Parametric study of response of an asymmetric building for various earthquake resistance factors" In this paper Earthquake is a major concern in high seismic prone areas. The structure which lies in seismic zones are to be specially designed. The goal of earthquake-resistant design is to construct structures that fare better during seismic activity than their conventional counterparts. In this paper a study is conducted on the performance of a asymmetric structure, with plan irregularity, strength and stiffness irregularities. A time history analysis is performed using Relevant software, a comparative discussion is made on the response of structure between normal building and building which is designed for earthquake resistant. The results showed that it was important to select a suitable parameter, for the type of resistance that the building must offer. This parametric study clears the importance of each earthquake resistance factors.

Khante.S.N, Lavkesh R.Wankhade Presented "Study ofseismic response of symmetric and asymmetric base isolated building with mass asymmetry in plan" In this paper, the effect of mass asymmetry in symmetric and asymmetric building is studied. To study the effect of torsion in seismic behavior of base isolated structures, a symmetric and asymmetric multi story concrete building is reference model. These models with mass eccentricity of 5%,10%, 15% and 20% of greatest dimension of building in indirection and bidirectional are considered. The response spectrum and non linear time history analysis of this eccentric model of fixed base and base isolated building using SAP2000 software is done.

TYPES OF LOADS ON STRUCTURES (BUILDINGS AND OTHER STRUCTURES)

GENERAL

The types of loads acting on structures for buildings and other structures can be broadly classified as vertical loads, horizontal loads and longitudinal loads. The vertical loads consist of dead load, live load and impact load. The horizontal loads comprises of wind load and earthquake load. The longitudinal loads i.e. tractive and braking forces are considered in special case of design of bridges, gantry girders etc.



TYPES OF LOADS ACTING ON A STRUCTURE ARE:

- Dead loads
- Imposed loads
- Wind loads
- Snow loads
- Earthquake loads
- Special loads

PROBLEM STATEMENT

In the present study, analysis of G+5, G+10, G+15 multi-story buildings in most severs zone for wind and earth quake forces is carried out.3D model is prepared for these cases multi-story building is in SAP2000. Building has a typical size of

Basic parameters considered for the analysis are

1. Utility of building : Residential building
2. Number of stories : G+5, G+10, G+15
3. Shape of building : Square
4. Beam : 0.3mX0.3m
5. Column : 0.5mX0.5m
6. Slab : 0.15m (150mm)
7. Geometric details

a. Ground floor : 3m

b. floor to floor height : 3.3m

8. Material details

a. Concrete Grade : M25(COLUMNS AND BEAMS)

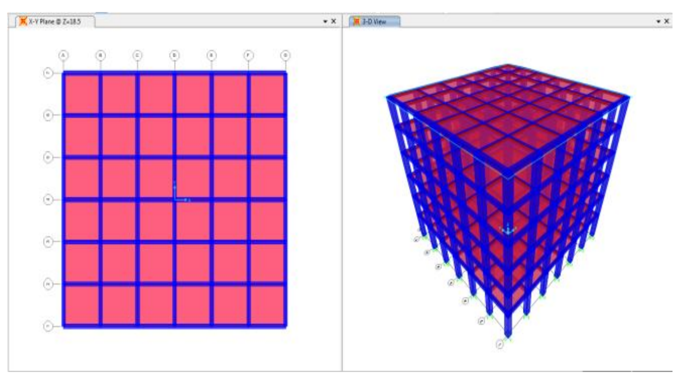
b. All Steel Grades : HYSD reinforcement of Grade Fe415

c. Bearing Capacity of Soil: 200KN/m^2

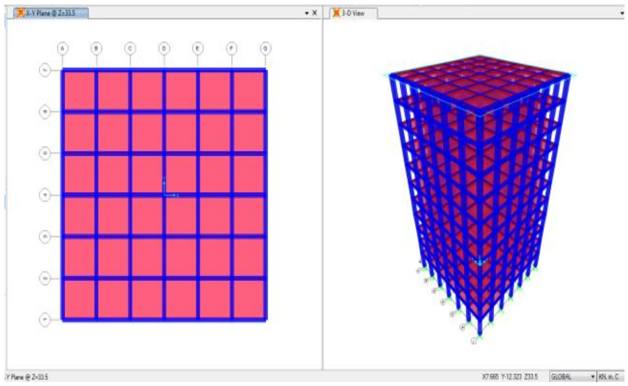
Type Of Construction :R.C.C FRAMED structure

MODELS IN SAP2000

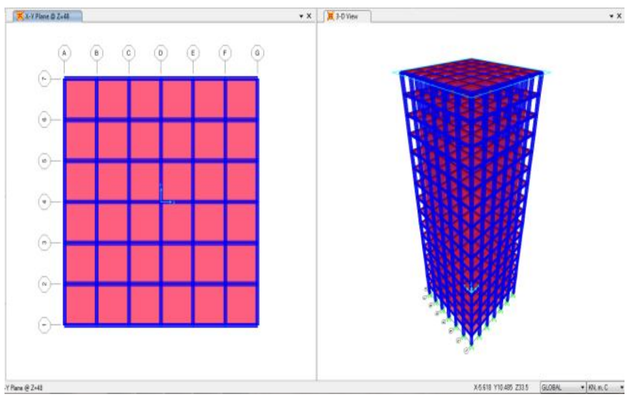
G+5



G+10



G+15

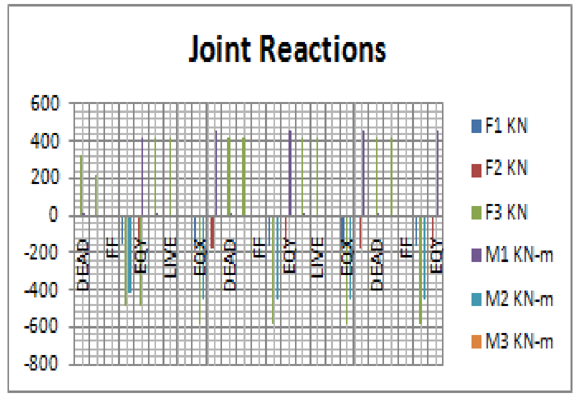


RESULTS AND ANALYSIS

I. G+5

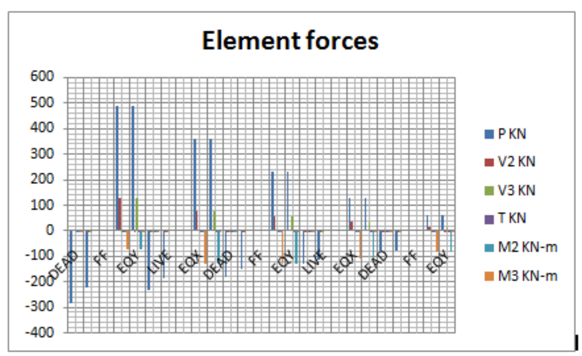
1. Joint Reactions

joint	load	F1 KN	F2 KN	F3 KN	M1 KN-m	M2 KN-m	M3 KN-m
1	DEAD	-5.338	-4.192	321.871	9.9238	-16.2099	-1.5969
1	LIVE	2.265	2.265	218.317	-2.7618	2.7618	-1.25E-17
1	FF	0	0	0	0	0	0
1	EQX	-151.799	-2.586	-485.896	3.2132	-422.2449	1.7568
1	EQY	-2.586	-151.799	-485.896	422.2449	-3.2132	-1.7568
8	DEAD	-4.937	-5.962	418.091	11.979	-15.2614	-1.4297
8	LIVE	4.409	0.294	415.229	-0.4644	5.3629	-0.0098
8	FF	0	0	0	0	0	0
8	EQX	-169.179	-0.283	-582.033	0.5126	-449.2651	0.8809
8	EQY	0.278	-181.187	5.389	456.275	0.3356	-1.1259
15	DEAD	-4.738	-6.042	423.224	12.1132	-14.6522	-1.4108
15	LIVE	4.462	0.097	424.921	-0.174	5.4385	0.0055
15	FF	0	0	0	0	0	0
15	EQX	-170.446	-0.135	-583.67	0.2462	-451.8658	0.0798
15	EQY	-0.013	-181.013	0.809	456.4962	-0.0152	-1.176
22	DEAD	-4.57	-6.096	423.917	12.2071	-14.1593	-1.3898
22	LIVE	4.463	-5.42E-15	424.523	1.62E-14	5.4388	9.04E-16
22	FF	0	0	0	0	0	0
22	EQX	-170.522	2.89E-12	-583.205	-7.95E-12	-452.0271	-1.96E-12
22	EQY	8.57E-15	-181.301	-3.36E-13	456.9571	1.15E-14	-1.1713
29	DEAD	-4.421	-6.132	424.703	12.274	-13.726	-1.3909
29	LIVE	4.462	-0.097	424.921	0.174	5.4385	-0.0055
29	FF	0	0	0	0	0	0
29	EQX	-170.446	0.135	-583.67	-0.2462	-451.8658	-0.0798
29	EQY	0.013	-181.013	-0.809	456.4962	0.0152	-1.176



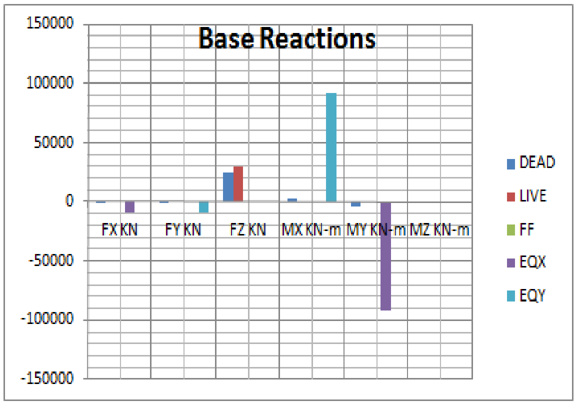
2. Element Forces (Frames)

STORY	load	P KN	V2 KN	V3 KN	T KN	M2 KN-m	M3 KN-m
1	DEAD	-280.002	4.338	3.192	0.5969	-0.2491	0.0253
1	LIVE	-218.317	-2.265	-2.265	1.25E-17	5.1652	5.1652
1	FF	0	0	0	0	0	0
1	EQX	485.896	129.93	2.586	-1.7568	-5.8395	-70.781
1	EQY	485.896	2.586	129.93	1.7568	-70.781	-5.8395
2	DEAD	-231.445	1.046	0.592	0.3893	-1.1609	-1.7159
2	LIVE	-184.442	-4.52	-4.52	1.55E-16	6.6149	6.6149
2	FF	0	0	0	0	0	0
2	EQX	356.886	76.495	4.748	0.0854	-6.8935	-128.6135
2	EQY	356.886	4.748	76.495	-0.0854	-128.6135	-6.8935
3	DEAD	-181.995	0.127	-0.098	0.2809	-0.8526	-1.4619
3	LIVE	-148.922	-4.704	-4.704	4.96E-16	7.145	7.145
3	FF	0	0	0	0	0	0
3	EQX	230.87	55.023	4.122	0.6849	-5.9412	-127.8258
3	EQY	230.87	4.122	55.023	-0.6849	-127.8258	-5.9412
4	DEAD	-130.346	-0.785	-0.829	0.2004	-0.0116	-0.4347
4	LIVE	-112.174	-5.022	-5.022	6.06E-16	7.5797	7.5797
4	FF	0	0	0	0	0	0
4	EQX	130.021	35.267	3.238	0.5406	-4.558	-106.9587
4	EQY	130.021	3.238	35.267	-0.5406	-106.9587	-4.558
5	DEAD	-76.277	-1.489	-1.413	0.1384	0.7782	0.5204
5	LIVE	-74.478	-5.149	-5.149	3.79E-16	7.5902	7.5902
5	FF	0	0	0	0	0	0
5	EQX	59.704	17.468	2.232	0.2931	-3.0194	-80.1318
5	EQY	59.704	2.232	17.468	-0.2931	-80.1318	-3.0194



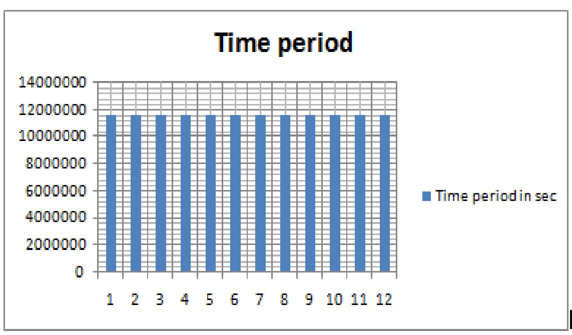
3. Base Reactions

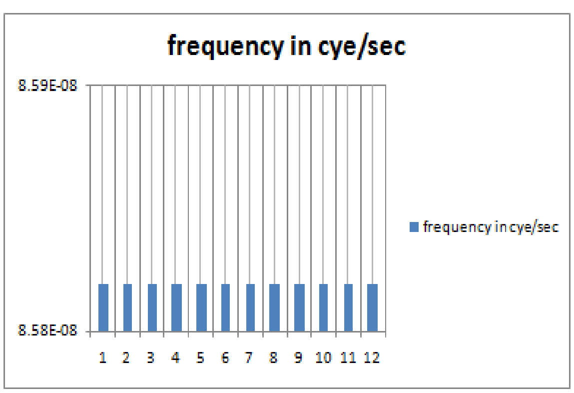
LOAD	FX KN	FY KN	FZ KN	MX KN-m	MY KN-m	MZ KN-m
DEAD	-343	-343	24714.72	2891	-3577	-343
LIVE	4.58E-13	-2.81E-13	29151.39	-2.68E-11	-8.50E-11	7.82E-13
FF	0	0	0	0	0	0
EQX	-9223.18	7.82E-13	1.30E-11	1.55E-11	-92122.873	-1.46E-09
EQY	9.15E-13	-9223.18	-2.22E-12	92122.8726	1.27E-11	1.98E-09



4. TIME PERIOD AND FREQUENCY

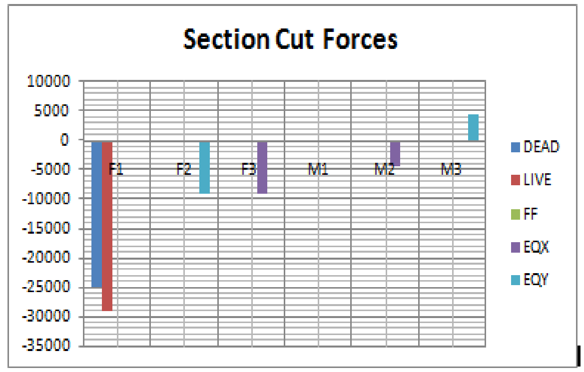
output case	step number	period in sec	frequency in cye/sec
MODAL	1	11654463.42	8.58E-08
MODAL	2	11654463.42	8.58E-08
MODAL	3	11654463.42	8.58E-08
MODAL	4	11654463.42	8.58E-08
MODAL	5	11654463.42	8.58E-08
MODAL	6	11654463.42	8.58E-08
MODAL	7	11654463.42	8.58E-08
MODAL	8	11654463.42	8.58E-08
MODAL	9	11654463.42	8.58E-08
MODAL	10	11654463.42	8.58E-08
MODAL	11	11654463.42	8.58E-08
MODAL	12	11654463.42	8.58E-08





5. Section Cut Forces

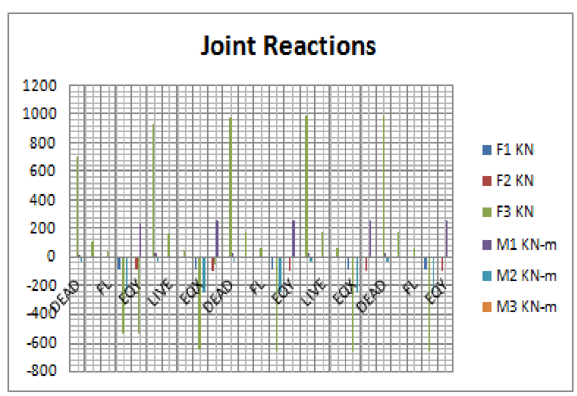
SECTION CUT TEXT	LOAD	F1	F2	F3	M1	M2	M3
SCUT1	DEAD	-25057.7	0	1.57E-12	2.74E-13	-1.32E-11	4.52E-12
SCUT1	LIVE	-29151.4	0	1.79E-12	-2.84E-14	-5.95E-12	-2.81E-12
SCUT1	FF	0	0	0	0	0	0
SCUT1	EQX	-2.76E-12	0	-9064.95	1.09E-11	-4333	-4.32E-12
SCUT1	EQY	1.74E-12	-9064.95	0	-1.82E-11	5.62E-12	4333.001



II. G+10

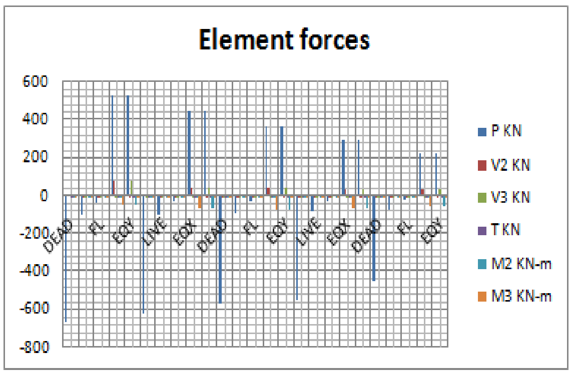
1. Joint Reactions

JOINT NO	LOAD	F1 KN	F2 KN	F3 KN	M1 KN-m	M2 KN-m	M3 KN-m
1	DEAD	-10.121	-8.056	709.286	19.9711	-28.74	-1.3041
1	LIVE	0.092	0.092	103.027	-0.1119	0.1119	7.31E-17
1	FL	0.031	0.031	34.342	-0.0373	0.0373	8.97E-18
1	EQX	-83.455	-1.187	-531.732	1.6735	-235.687	0.1756
1	EQY	-1.187	-83.455	-531.732	235.6868	-1.6735	-0.1756
13	DEAD	-10.358	-10.169	939.169	22.3847	-28.3749	-1.2659
13	LIVE	0.156	0.097	163.228	-0.1162	0.1844	2.00E-05
13	FL	0.052	0.032	54.409	-0.0387	0.0615	6.67E-06
13	EQX	-90.627	-0.522	-650.351	0.8419	-244.208	0.0866
13	EQY	-0.211	-102.079	-53.61	257.0009	-0.3387	-0.0843
25	DEAD	-9.924	-10.374	981.68	22.6285	-27.2417	-1.2888
25	LIVE	0.169	0.018	175.083	-0.0234	0.1993	-1.15E-05
25	FL	0.056	0.005941	58.361	-0.0078	0.0664	-3.84E-06
25	EQX	-90.775	-0.214	-659.572	0.3705	-244.527	0.0348
25	EQY	-0.053	-102.082	-9.102	257.1419	-0.0899	-0.0641
37	DEAD	-9.52	-10.424	990.418	22.6888	-26.1353	-1.2761
37	LIVE	0.171	6.30E-16	176.774	5.56E-17	0.2015	7.05E-17
37	FL	0.057	3.84E-16	58.925	-3.78E-16	0.0672	9.30E-18
37	EQX	-90.854	-7.71E-11	-660.566	2.02E-10	-244.665	9.94E-12
37	EQY	-2.50E-11	-102.217	-2.42E-10	257.3392	-7.00E-11	-0.0478
49	DEAD	-9.11	-10.45	988.947	22.715	-25.0122	-1.2949
49	LIVE	0.169	-0.018	175.083	0.0234	0.1993	1.15E-05
49	FL	0.056	-0.00594	58.361	0.0078	0.0664	3.84E-06
49	EQX	-90.775	0.214	-659.572	-0.3705	-244.527	-0.0348
49	EQY	0.053	-102.082	9.102	257.1419	0.0899	-0.0641



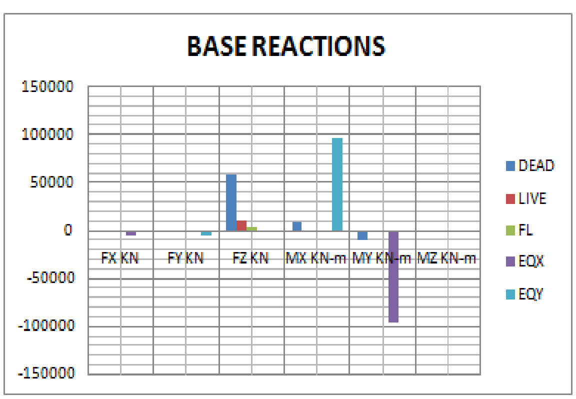
2. Element Forces (Frames)

STORY NO	LOAD	P KN	V2 KN	V3 KN	T KN	M2 KN-m	M3 KN-m
1	DEAD	-667.418	9.121	7.056	0.3041	-3.7251	-4.1843
1	LIVE	-103.027	-0.092	-0.092	-7.31E-17	0.2107	0.2107
1	FL	-34.342	-0.031	-0.031	-8.97E-18	0.0702	0.0702
1	EQX	531.732	79.955	1.187	-0.1756	-2.4807	-50.2802
1	EQY	531.732	1.187	79.955	0.1756	-50.2802	-2.4807
2	DEAD	-617.04	3.518	2.574	0.397	-3.7637	-4.9792
2	LIVE	-95.542	-0.279	-0.279	-1.10E-16	0.456	0.456
2	FL	-31.847	-0.093	-0.093	-4.40E-18	0.152	0.152
2	EQX	450.704	45.152	1.165	0.1585	-1.8501	-66.3298
2	EQY	450.704	1.165	45.152	-0.1585	-66.3298	-1.8501
3	DEAD	-564.892	2.666	1.882	0.382	-3.3236	-4.6544
3	LIVE	-87.482	-0.419	-0.419	-1.49E-16	0.6649	0.6649
3	FL	-29.161	-0.14	-0.14	-1.49E-17	0.2216	0.2216
3	EQX	367.86	41.029	1.828	0.0103	-2.6162	-68.6217
3	EQY	367.86	1.828	41.029	-0.0103	-68.6217	-2.6162
4	DEAD	-546.372	1.468	0.87	0.3474	0.4649	1.0833
4	LIVE	-78.921	-0.544	-0.544	-1.70E-16	0.8472	0.8472
4	FL	-26.307	-0.181	-0.181	-1.80E-17	0.2824	0.2824
4	EQX	290.989	35.322	1.689	0.0038	-2.5548	-63.5116
4	EQY	290.989	1.689	35.322	-0.0038	-63.5116	-2.5548
5	DEAD	-450.987	0.511	0.059	0.3067	-0.9945	-1.9777
5	LIVE	-69.921	-0.652	-0.652	-1.75E-16	1.0051	1.0051
5	FL	-23.307	-0.217	-0.217	-7.99E-18	0.335	0.335
5	EQX	222.368	30.697	1.699	0.00091	-2.5307	-57.5412
5	EQY	222.368	1.699	30.697	-0.00091	-57.5412	-2.5307



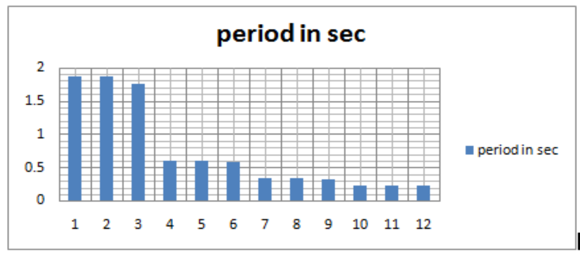
3. Base Reactions

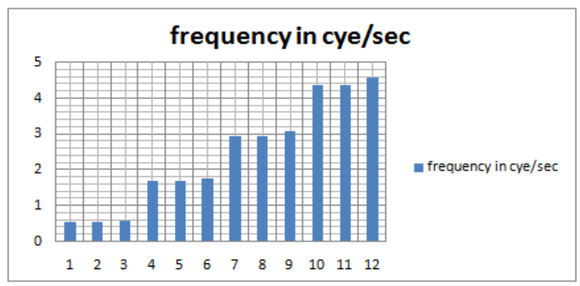
output case	FX KN	FY KN	FZ KN	MX KN-m	MY KN-m	MZ KN-m
DEAD	-588	-588	57931.48	9383.5	-10559.5	-588
LIVE	-1.78E-14	-1.97E-15	10692	9.78E-12	7.19E-11	1.07E-13
FL	-2.05E-15	2.53E-15	3564	1.99E-12	2.71E-11	1.23E-14
EQX	-5109.26	-1.43E-09	-4.21E-12	3.48E-08	-96814.5	1.91E-08
EQY	-1.42E-09	-5109.26	2.27E-12	96814.48	-3.48E-08	1.97E-08



4. Time Period And Frequency

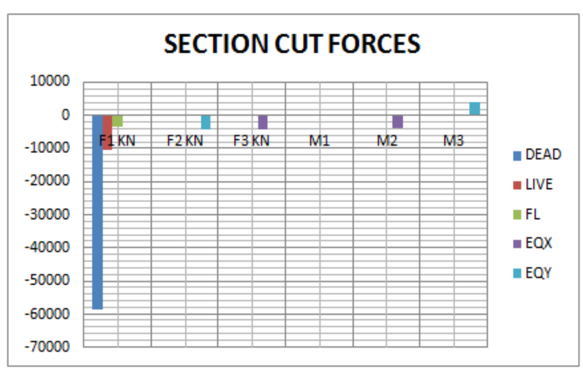
output case	step number	period in sec	frequency in cye/sec
MODAL	1	1.860031	0.537625316
MODAL	2	1.860031	0.537625316
MODAL	3	1.763539	0.567041629
MODAL	4	0.602066	1.660948392
MODAL	5	0.602066	1.660948392
MODAL	6	0.57141	1.750058128
MODAL	7	0.34033	2.938326618
MODAL	8	0.34033	2.938326618
MODAL	9	0.325062	3.076335625
MODAL	10	0.229042	4.366005922
MODAL	11	0.229042	4.366005922
MODAL	12	0.218117	4.584704817





5. Section Cut Forces

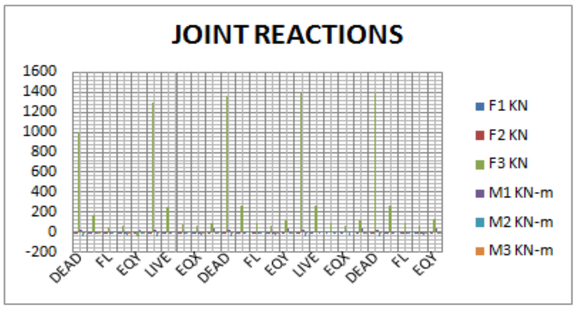
SECTION CUT TEXT	OUTPUT CASE	F1 KN	F2 KN	F3 KN	M1	M2	M3
SCUT1	DEAD	-58519.5	-6.79E-10	6.30E-10	-3.19E-09	3.53E-09	3.92E-09
SCUT1	LIVE	-10692	-6.55E-15	6.61E-13	-5.49E-14	2.01E-13	-5.47E-13
SCUT1	FL	-3564	-2.57E-15	2.16E-13	4.49E-14	1.13E-12	3.62E-13
SCUT1	EQX	-1.83E-12	-1.59E-09	-4413.5	-7.89E-10	-3931.52	8.64E-09
SCUT1	EQY	1.26E-12	-4413.5	-2.01E-09	-3.11E-08	-1.19E-08	3931.521



III. G+15

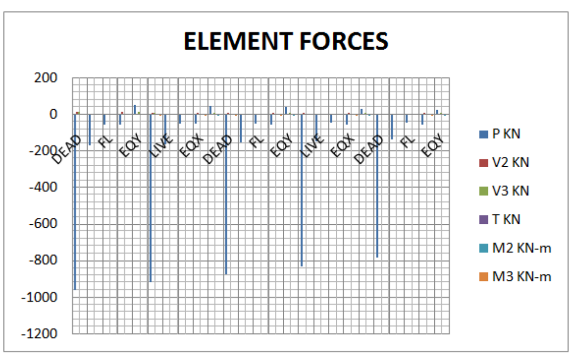
1. Joint Reactions

joint text	output case	F1 KN	F2 KN	F3 KN	M1 KN-m	M2 KN-m	M3 KN-m
1	DEAD	-14.021	-10.385	1000.152	26.7842	-38.5438	-1.3772
1	LIVE	0.112	0.787	172.485	-0.78	0.1157	0.000651
1	FL	0.037	0.262	57.495	-0.26	0.0386	0.000217
1	EQX	-11.016	0.134	62.156	-0.0834	-31.7338	0.0196
1	EQY	-0.033	-11.184	-45.357	31.8979	-0.0806	-0.0196
18	DEAD	-14.562	-14.327	1291.683	30.6025	-38.1497	-1.3307
18	LIVE	0.187	0.123	249.083	-0.1362	0.1869	0.000233
18	FL	0.062	0.041	83.028	-0.0454	0.0623	7.78E-05
18	EQX	-12.213	-0.056	64.531	0.0887	-32.9455	0.0131
18	EQY	0.124	-14.492	91.994	35.1116	0.1049	-0.0112
35	DEAD	-13.951	-14.552	1365.347	30.8388	-36.635	-1.3587
35	LIVE	0.201	0.042	268.642	-0.0501	0.2	4.55E-05
35	FL	0.067	0.014	89.547	-0.0167	0.0667	1.52E-05
35	EQX	-12.234	-0.024	67.431	0.0411	-32.9903	0.0042
35	EQY	0.153	-14.568	117.449	35.21	0.145	-0.0069
52	DEAD	-13.372	-14.65	1386.825	30.94	-35.1382	-1.3442
52	LIVE	0.203	6.55E-15	272.722	-1.56E-14	0.2023	-2.67E-16
52	FL	0.068	2.23E-15	90.907	-5.33E-15	0.0674	-5.51E-17
52	EQX	-12.246	-2.09E-11	68.107	5.06E-11	-33.0093	1.94E-12
52	EQY	0.165	-14.606	125.882	35.255	0.1608	-0.0059
69	DEAD	-12.78	-14.705	1384.961	30.9868	-33.6139	-1.367
69	LIVE	0.201	-0.042	268.642	0.0501	0.2	-4.55E-05
69	FL	0.067	-0.014	89.547	0.0167	0.0667	-1.52E-05
69	EQX	-12.234	0.024	67.431	-0.0411	-32.9903	-0.0042
69	EQY	0.176	-14.581	133.092	35.2241	0.1768	-0.0069



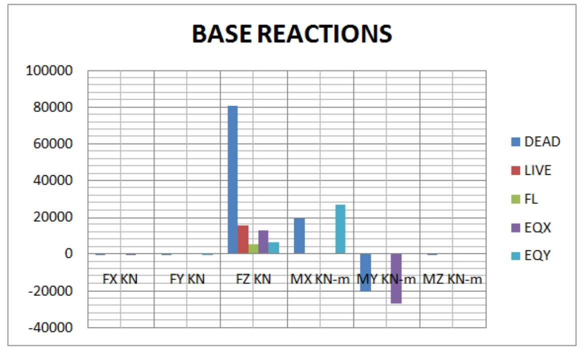
2. Element Forces (Frames)

STOREY NO	LOAD	P KN	V2 KN	V3 KN	T KN	M2 KN-m	M3 KN-m
1	DEAD	-964.407	13.021	9.385	0.3772	-0.3712	-1.5182
1	LIVE	-172.485	-0.112	-0.787	-0.00065	1.5805	0.2191
1	FL	-57.495	-0.037	-0.262	-0.00022	0.5268	0.073
1	EQX	-56.156	11.016	-0.134	-0.0196	0.3174	-1.3155
1	EQY	48.357	0.033	11.184	0.0196	-1.6526	-0.0198
2	DEAD	-921.354	7.061	4.202	0.5695	-4.372	-7.8123
2	LIVE	-165.096	-0.295	-1.424	0.000772	2.1209	0.4964
2	FL	-55.032	-0.098	-0.475	0.000257	0.707	0.1655
2	EQX	-55.237	7.247	-0.394	0.0146	0.5386	-7.5477
2	EQY	43.187	-0.09	7.551	-0.0146	-7.9975	0.0888
3	DEAD	-879.16	5.422	2.953	0.5897	-4.4613	-8.2033
3	LIVE	-156.968	-0.475	-1.535	-0.00015	2.3596	0.7576
3	FL	-52.323	-0.158	-0.512	-4.89E-05	0.7865	0.2525
3	EQX	-56.226	6.602	-0.304	0.0038	0.4807	-8.908
3	EQY	35.962	0.014	6.92	-0.0038	-9.3961	-0.0074
4	DEAD	-834.017	4.076	1.798	0.5641	-3.3161	-6.9649
4	LIVE	-148.191	-0.635	-1.713	3.70E-05	2.611	0.994
4	FL	-49.397	-0.212	-0.571	1.23E-05	0.8703	0.3313
4	EQX	-57.288	6.231	-0.34	0.000746	0.514	-9.0191
4	EQY	28.543	0.011	6.582	-0.00075	-9.5522	-0.0191
5	DEAD	-785.193	2.972	0.853	0.5263	-2.041	-5.5036
5	LIVE	-138.825	-0.78	-1.862	-7.17E-06	2.8315	1.2069
5	FL	-46.275	-0.26	-0.621	-2.39E-06	0.9438	0.4023
5	EQX	-57.975	5.976	-0.359	0.000199	0.5461	-8.8933
5	EQY	21.391	0.017	6.352	-0.0002	-9.4648	-0.0254



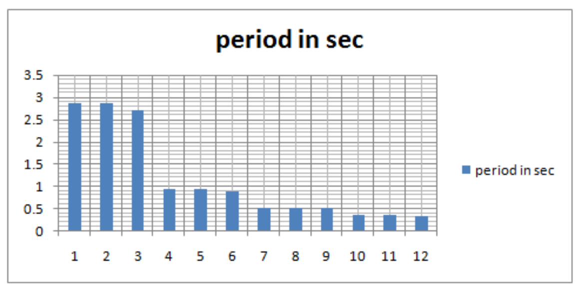
3. Base Reactions

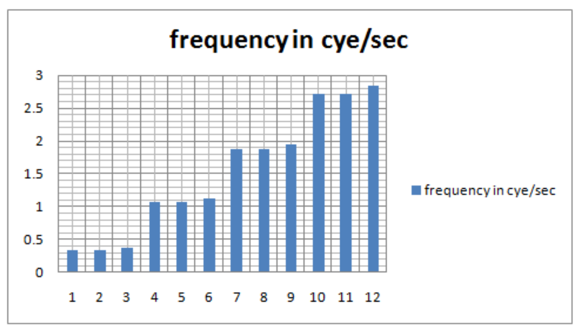
LOAD	FX KN	FY KN	FZ KN	MX KN-m	MY KN-m	MZ KN-m
DEAD	-833	-833	80739.36	19159	-20825	-833
LIVE	-7.68E-14	1.19E-13	15552	-3.68E-11	-4.03E-11	-5.63E-13
FL	-2.28E-14	4.91E-14	5184	-1.07E-11	-1.41E-11	-1.21E-13
EQX	-731.289	-4.84E-10	12768	1.60E-08	-26896.8	4.42E-09
EQY	-4.84E-10	-731.289	6384	26896.8	-1.61E-08	1.19E-08



4. Time Period And Frequency

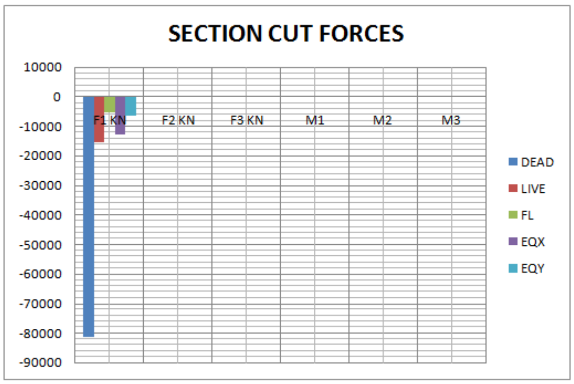
out put case	step number	period in sec	frequency in cye/sec
MODAL	1	2.873646	0.34798999
MODAL	2	2.873646	0.34798999
MODAL	3	2.703447	0.36989812
MODAL	4	0.936898	1.06735157
MODAL	5	0.936898	1.06735157
MODAL	6	0.885957	1.12872353
MODAL	7	0.534211	1.87191912
MODAL	8	0.534211	1.87191912
MODAL	9	0.513545	1.94724926
MODAL	10	0.367399	2.72183815
MODAL	11	0.367399	2.72183815
MODAL	12	0.352817	2.83433008





5. Section Cut Forces

SECTION CUT FORCES	LOAD	F1 KN	F2 KN	F3 KN	M1	M2	M3
SCUT1	DEAD	-81572.4	-1.76E-09	1.67E-09	-9.82E-09	1.39E-08	1.28E-08
SCUT1	LIVE	-15552	-5.50E-15	9.61E-13	-8.26E-14	-1.24E-11	1.79E-12
SCUT1	FL	-5184	1.33E-15	3.22E-13	1.33E-14	-2.21E-12	-2.38E-12
SCUT1	EQX	-12768	-7.47E-10	3.00E-09	3.45E-10	2.59E-08	6.08E-09
SCUT1	EQY	-6384	-1.90E-09	-7.27E-10	-1.13E-08	-6.01E-09	1.80E-08



CONCLUSIONS

The following conclusions are made from the current study

1. Element forces (frames) decreases from bottom story to top story in all three cases

2. The period as well as frequency is constant in case of G+5.

3. For G+10 and G+15 stories the values of time period are decreases from step number1 to step number 12.

4. Frequency values for G+10 and G+15 are increasing from step number 1 to step number 12.

5. Base reaction values are more in the EQY loading case in all models

6. Section cut forces is also maximum in the EQY loading condition in all the models

7. Performance of Asymmetrical building is better than Symmetrical building for given loading and soil condition.

8. Base shear of Symmetrical structure is more as compare to Asymmetrical structure.

9. Tensional moment in asymmetrical structure is more than symmetrical structure

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