STUDY OF BEHAVIOUR OF TUBULAR TALL BUILDING (SUBJECTED TO WNID AND EARTH_QUAKE FORCES)

A
Dissertation
Submitted in Partial Fulfillment of the Requirements
for Award of the Degree of

MASTER OF ENGINEERING
IN
STRUCTURAL ENGINEERING

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(**RAHUL SHERKE**)

CANDIDATE'S DECLARATION

I herby certify that the work presented in this dissertation entitled "**STUDY OF BEHAVIOUR OF TUBULAR TALL BUILDING (SUBJECTED TO WIND AND EARTHQUAKE FORCES)"** in partial fulfillment of the requirements for the award of the degree of **MASTER OF ENGINEERING** in Civil Engineering, with specialization in **Structural Engineering,** submitted to the Department of Civil and Environmental Engineering, Delhi College of Engineering, Delhi is an authentic record of my own work, under the supervision of **Asst. Prof. G.P.Awadhiya** ,Department of Civil Engineering ,Delhi College of Engineering, Delhi

The matter embodied in this dissertation has not been submitted by me for the award of any other degree.

Date: (**RAHUL SHERKE**)
Place: Delhi

CERTIFICATE

This is to certify that the above statement made by the candidate is correct to the best of our knowledge.

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ABSTRACT

In this project, Analysis of Tubular tall building has been done using STAAD PRO.

It has been presumes that, the only periphery Beams/Columns essentially take part in resisting lateral forces and the interior beams and columns transfer gravity load to foundation.
This assumption work fairly well in resisting static wind forces and gravity load.

When the outer tube is subjected to lateral wind forces the flange and web frames columns experience the positive shear lag phenomenon also.
In the first phase pf the research effort, we tried to study the maximum deflection, of the tube without and with shear wall; staggerres shear panels and other patterns of shear panels.

It has been observed that if staggered shear panels are used up to 1/3rd height of the tube, they control maximum deflection at top more then that is done by the shear walls provided up to full height.

In the second phase of analysis the tubular tall building has been analyses for dynamic forces using STAAD PRO, RESPONSE SPECTRAM METHOD.

To apply dynamic forces, complete tabular tall building has been considered of normal dimensions which can be just sufficient to resist the gravity Dead load and Live load.

The deformation pattern is completely different.

Chapter 1

Introduction

It is only in the last 30 years that reinforced concrete has found increasing use in the construction of tall buildings. In its initial development in the early 1900s reinforced concrete buildings were limited to only a few stories in height. The structural type used was the traditional beam-column frame system which made the construction of taller buildings relatively expensive and, therefore, economically unfeasible. In the early 1950s, the introduction of shear wall type of construction opened up the possibility of using concrete in apartment and office buildings as high as 30 stories. Taller buildings still remained economically unattractive, and technically inadequate, because the shear walls which were mostly used in the core of the building were relatively small in dimension compared to the height of such buildings, leading to insufficient stiffness to resist lateral loads. It was obvious that the overall dimensions of the interior cores were too small to economically provide the stability and stiffness for buildings over 30 or 40 stories.

The natural tendency then was to find new systems that would utilize the perimeter configurations of such buildings rather than to rely on the core configurations alone. The development of the framed tube system was, therefore, a logical outcome of this challenge. The framed tube system in its simplest form consists of closely spaced exterior columns tied at each floor level with relatively deep spandrel- beams, thereby creating the effect of a hollow concrete tube perforated by openings for the windows. Since the system simulated a hollow tube using perimeter closely spaced frame elements, it is referred to as "framed tube". This system was apparently first applied on the design of the 43-story DeWitt-Chestnut apartment building in Chicago in 1963. Since then the system has received wide acceptance among designers all over the world, and many variations are being used in a number of buildings under construction.

From the point of view of construction economy, the framed tube compares favorably with the normal shear wall type of construction for medium-rise buildings, but provides a distinct economic advantage for taller buildings. Moreover, the closely spaced column system has the additional advantage of also being the window wall system, thus replacing the vertical mullions for the support of the glass windows. In some recent buildings the elimination of the traditional curtain wall with its metallic mullions was in itself the justification for choosing this structural system.

The framed tube structural system has expanded in its application and in its variation over the last five years. One of these variations is its application with an interior shear wall, commonly referred to as ‘tube-in-tube’ system, as used in the 52-story One Shell Plaza Building in Houston, reaching a height of 714 ft.

In view of the wide and varied application of the framed tube system, there is an obvious need for developing a preliminary analysis and design method for such a system.

Modern high rise buildings are usually built with the tube concept because of their structural efficiency which places the lateral load resisting elements on the outside perimeter.

As these structures are very tall (normally above 40 stories have a large number of structural elements and joints which make finite element analysis very expensive.

F. R. Khan's approach of link connectivity in which shear links for the compatibility of vertical shear deformation between flange and web frame panels have been used has its limited application to symmetric structures only.

As the floors provide sufficient in-plane rigidity which has been used to consider rigid body horizontal displacements and rigid body rotation of the tube about its elastic centre. During analysis it has been observed that almost in middle 1/3rd ht. of the tubular structures negative shear lag apparently influences the share of intermediate columns in flange panels and corner columns in stress mobilization.

As the optimum utilization of material in mobilizing stress contribution caused by lateral loading is being the prime objective of designers for such structures, spandrel beams play vital role to appreciate flange panel's intermediate columns to embrace shear contribution from corner columns. As the negative shear lag is almost independent of intermediate columns and corner columns area ratio, in the upper half of tall structures cross sectional area for both type of columns may be kept same. In lower 1/3rd ht. of structure flange panel’s intermediate columns seem to be scared of stress shearing Therefore in this region these columns can be mobilized to take part actively by making use of shear panels. By arranging shear panels in a special order greater efficiency can be achieved. An especial order of staggering proves better than shear walls in structural functioning and it can be accommodated ideas of Architect as well.

One last but not the least point needs to be given here is that this approach can accommodate the analysis for Tube-in-Tube structures as well.

Before going through detailed analysis let us examine some macro aspects of tubular structures:

1. Tubular structures are designed as a perforated tube comprising of oblique/orthogonal frame panels which are made of closely spaced columns linked by spandrel beams around the perimeter at each floor level.
2. The columns in framed tube structures have centre to centre spacing of 1.5 - 3.0 meters depending upon the geometry of the building
3. Spandrel beams normally 0.5 - 1.2 meter in depth and 0.3- 1.6 M in width are provided.
4. The spandrel beams and the columns have adequate stiffness stability against lateral sway and also to provide overall strength in the system.
5. Slabs are fairly rigid in their own plane.
6. All elements of frames are taken to be prismatic and of linearly elastic material.

BEHAVIOR OF THE FRAMED TUBE SYSTEM

The framed tube system combines the behavior of a true cantilever, such as a shear wall, with that of a beam-column frame. The overturning under lateral load is resisted by the tube form causing compression and tension in the columns, while the shear from the lateral load is resisted by bending in columns and beams primarily in the two sides of the building parallel to the direction of the lateral load. Therefore, for all practical purposes the bending moments in these columns can be determined by judicious choice of the point of contra flexure in each storey. While it is true that in the lower few stories, as well as in the upper few stories, the point of contra flexure does not remain in the middle of story height, the intermediate stories which constitute the major portion of the building generally have the point of contra flexure at mid-height of each story. It is, therefore, possible to compute the bending moments in these columns with reasonable accuracy for any known lateral shear at each story. An iterative solution will also give a good approximation of that portion of the total deflection which is caused by the frame action only. To this the additional overturning deflection caused by tension or compression in the column must be added to compute the total lateral deflection.

The cantilever tube type behavior becomes significant when the overturning of the entire building due to lateral load is considered. For analyzing the overturning of the entire framed tube, the exterior column system can be considered as part of a rigidly diaphragm hollow tube. However, in recognition of the fact that the webs of the hollow tube, that is, the two sides parallel to the direction of the lateral force, are not truly solid webs but are, in fact, grid frames, one must consider then the effect of loss of efficiency due to the flexibility of this web-frame causing what is known as shear lag. For a very preliminary estimate of the overall resistance, as well as the deflection of the building, the effective configuration of the tube could be reduced to two equivalent channels resisting the total overturning moments. Experience has indicated that for preliminary designs channel flanges normally should not be more than half the depth of the web (walls parallel to lateral load), or more than about 10% of the height of the building. These approximate rules have generally given conservative values of shear and moment as compared to, the actual forces in the exterior columns obtained by the exact analysis performed subsequently by a generalized computer program such as STRESS, STRUDL, or others,

Bending beam and shear beam behaviors are not the only ones found in framed tubes. The shear-lag phenomenon is also present. This means that modeling of the building as an equivalent beam with shear and bending rigidities is not sufficient to capture the true behavior of a framed tube. But what is shear lag in tall buildings and how can it be defined? To explain this, some definitions must give. Fig.1 shows a frame tube structures. In fig.2 if the tube is loaded on side AB, then the whole frames (facades) of AB and CD are called flange frames, and the facades AD and BC are called web frames. When a framed tube is loaded laterally, at the lower floors, especially at the ground level (first floor), the force in the corner column is much larger than the force in the central column of the flange frame. On the other hand the forces in the web frame, instead of growing smaller towards the centre linearly, grow smaller much faster. This phenomenon is called shear lag. The shear flexibility of the flange frames make the structure behave differently than would be predicted by the engineering bending theory.

The ratio of the stress at the centre column to the stress in the corner column is defined as shear-lag factor.

At certain height, the stresses in all columns become equal and the shear lag factor becomes one. Above that height the shear lag factor grows larger than one and at same point it becomes infinite since the stresses at the corner, are zero. At even higher floors the corner column stresses change sign and thus shear lag factor becomes negative.

Shear-lag is one of the major concerns in tall buildings design. The designer must make the shear lag factor at the base as close to unity as possible. A shear lag factor of one can only be achieved with infinite shear rigidity of the flange panels. This is exactly what the classical engineering theory of assumes.

In practice a shear lag factor of 0.7 is considered satisfactory, so the concern for the designer are the lateral displacements the inter-storey displacements, and the rotation of the joints. A good design model should be able to give accurate results for all these.

2.2 VARIOUS FORMS OF TUBULAR BUILDINGS

To increase the rigidity for lateral load resistance and the functional requirements, different forms of framed tubes used like single cell tube, bundled tube, tube-in-tube, geometric plan shaped tubes, etc.

2.3 PREVIOUS WORK

For analysis of tube structures numerous approaches have been developed, some of them are used to have first hand analysis for rigorous finite element analysis. Some methods developed to have rigorous analysis using good computational facilities.

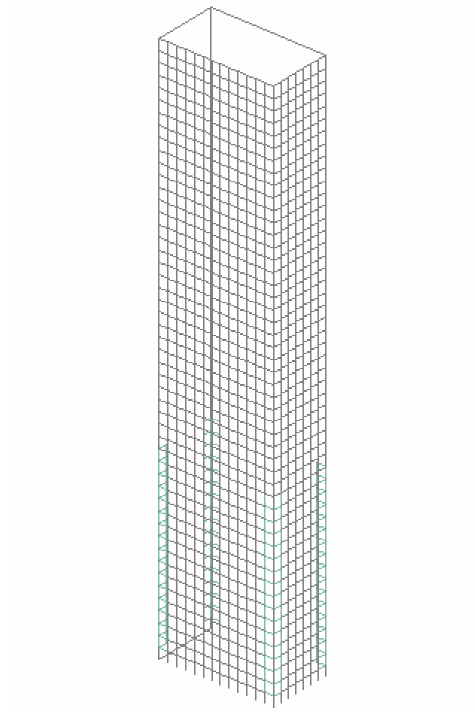


Fig 1 Frame Tube

2.3.1 An Approach by A. Coull and N.K. Subedi

In this paper, a simple grid method is presented for analysis of framed tube structure subjected to bending due to loading. By recognizing the dominant mode of behavior structures it is possible to reduce the analysis to that equivalent plane frame, with a consequent large reduction the amount of computation required in a conventional three dimensional analysis. The accuracy of the method is tested by comparing results with those from a model investigation and from a complete three dimensional solution with a commercially available standard computer program.

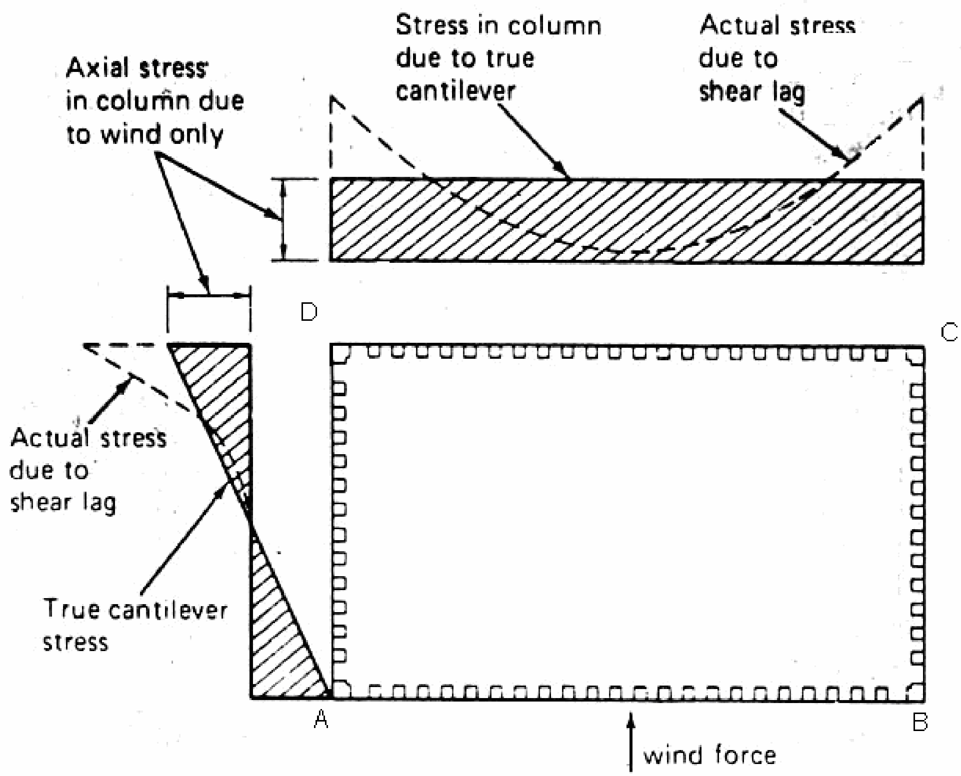


Fig.2 Axial Stress Distribution in the Columans due to Wind - true Cantilever v/s Actual Stress due to Shear Lag

2.3.2. The sub assemblage approach by Hibbard and Adams incorporates a technique developed for plane frames and involves an iterative solution for each load increment and an adjustment of the tensional in plane displacements of the rigid floor diaphragm.

2.3.3. Rotenberg has extended the Sway sub assemblage technique for plane frames to three dimensional problems by applying his direct fictious approach coupled to a successive centre-line-of-rigidity adjustments procedure. This effectively eliminates P-Delta iterations with regard to individual load increments, but a stiffness-evaluation is required at each level of loading, and the location of the centre rigidity needs constant up dating.

2.3.4 By M.C. Stamato and B.S. Smith

The method of Analysis is for building structures consisting two dimensional panels arranged in orthogonal or oblique planes. The panels may include frame, trusses, shear-walls or any combinations of these. It is assumed that the vertical concentrated forces are induced along the vertical intersections of panels at each storey to ensure the compatibility of displacement of the intersecting panels. The floors are assumed to be rigid diaphragms of infinite in-plane stiffness and zero transverse-stiffness thus transmitting only horizontal forces to the panel.

The displacement method is used to solve the resulting banded stiffness matrix which, with other simplifications allows the method to be used for the solution of large structures on smaller computers. In the particular case of structure where vertical displacements may be neglected, such as buildings of moderate height and slenderness with columns or walls at the intersections of panels:, the method becomes especially compact and rapid.

2.3.5 An Approach by Weaver and Nelson

In this paper a simple formulation has been presented for 3D analysis of symmetric and asymmetric structure and advantage of floor rigidity has been taken for the development of stiffness matrices and for computation of, displacements.

2.3.6. An Approach by F.R. Khan

F.R. Khan has modeled a framed tube as an equivalent plane frame. The interaction of web frame and flange frame is assumed to take place through transfer of shear at corner column only. Thus for analysis in-plane panel stiffness are taken into account.

2.3.7. An Approach By Kang-Kun Lee, Yew-Chafe Loo, and Hong Guan

A frames tube system with multiple internal tubes in analysis using an orthotropic box beam analogy approach in which each tube is individually modeled by a box beam that accounts for the flexural and shear deformation as well as the shear leg effects. The method idealizes the tubes in tube structure as a system of equivalent multiple tubes, each composed of four equivalent multiple tubes , each composed of four equivalent orthotropic plate panels capable of carrying axial loads and shear forces by simplifying the assumptions in relation to the patterns of strains of distributions in external and internal tube. The structural analysis reduces to the mars solutions of a single second order liner differentiation equation. The proposed method, which is intended to be used as a tool for preliminary design props, can be applied for the analysis of frame tube structure with single and multiple internal tube as well as those without internal tubes.

2.3.8. An Approach by Y. Singh and A. K. Nagpal

Occurrence of negative shear lag in framed-tube buildings under lateral loading is reported in his study, but explanation of its origin and comprehensive studies of it are lacking. The present analogy separates column axial-force distribution in a story into two modes; one contributing to the positive shear lag and the other to the negative shear lag. The net shear lag, positive or negative, is the resultant of the axial-force distributions in these modes. Further, an analogy between shear-lag behavior of a uniform box girder and uniform framed-tube building is established by interpreting structural parameters occurring in the closed form solution of a box girder in terms of those of the framed-tube building. Structural parameters governing the shear-lag behavior are identified, and their effect and of different loading types is studied.

The framed-tube structure is an efficient structural system for tall buildings in steel as well as concrete. In its basic form, the system consists of closely spaced columns along the periphery, interconnected by deep spandrel beams at each floor level. This produces a system of rigidly jointed orthogonal frame panels forming a rectangular tube. The overall bending behavior of a tubular building is similar to that of a box girder, though shear deformations, generally neglected in box girders, play an important role in tubular buildings. The occurrence of shear lag has long been recognized in hollow box girders as well as in tubular buildings. In tubular buildings, flexibility of spandrel beams produces a shear lag with the effect of increasing the axial stresses in the corner columns and of reducing them in the columns toward the center of the orthogonal frame panels. This effect produces warping of the floor slab and consequent deformation of interior partitions and secondary structures and making ideal beam theory no longer valid and stress variation much more complex.

2.3.9. An Approach by Quanfeng Wang and W. Y. Li

Based on the displacement variational principle, he had present a general consistent method, called the spline finite member element method, for buckling analysis of thin-walled eccentric compressive members with arbitrary cross sections considering shear lag. A transformed *B*3-spline function presented in his study is used to simulate the warping displacements along the cross section of the thin-walled member. Compared with the results from classical theory, the numerical results proposed in this paper demonstrate the versatility and accuracy of the proposed method.

2.3.10 An Approach By Timoshenko and Gere

The modern use of thin-walled structures in tall buildings and bridges with long spans has made elastic instability a problem of great importance. Timoshenko and Gere (1961) and Vlasov (1961) proposed analytical methods for buckling of thin-walled members; however, the shear lag phenomenon cannot be evinced correctly in their methods as known. Although the problem of shear lag in its manifestations has been recognized for several decades and has been studied in detail both analytically and experimentally for thin-walled members, no simple theory comparable to the Timoshenko or Vlasov theory has been developed to deal with shear lag (Gjelsvik 1991).

Chapter 3

Numerical Problem

Problem 1

This exercise was aimed to apply proposed method for the analysis of symmetric tubular structures of high height. To have comparison in the results same problem has been used here which have been solved by J.J. Conner and Pouangare

In this exercise a 49 storey tubular structure has been solved. In this case modulus of elasticity also varies with height of the building.

The geometry, loading and member properties have been given in fig.3

Results obtained using proposed methods have been plotted in graph.

Fig.4 shows the lateral displacements at each storey level. It can be seen from the figure that lateral displacements at each storey level are almost exact.

Fig.5 shows the variation in stresses in corner column, middle column. This also shows fairly good agreement with finite element analysis results.

Fig.6 have been plotted to show the variation of shear lag factor which shows that at the base shear lag factor is 0.3 and with the increase in height of the building shear lag factor goes on increasing and it becomes unity at 21st and 22nd storey. With the further increase in the height it grows faster and between 34th and 35th storey becomes infinite. Beyond this point corner column stresses change their sign, and negative shear lag factor becomes apparent. Fig.7 shows the variation of percentage shear lag (plotted in log scale) with the storey height.

STORIES	COLUMNS (cm x cm)
1-2	122 x 61
3-19	122 x 46
20-31	122 x 41
32-49	122 x 36

STORIES	BEAMS (cm x cm)
1	76 x 61
2-49	38 x 99

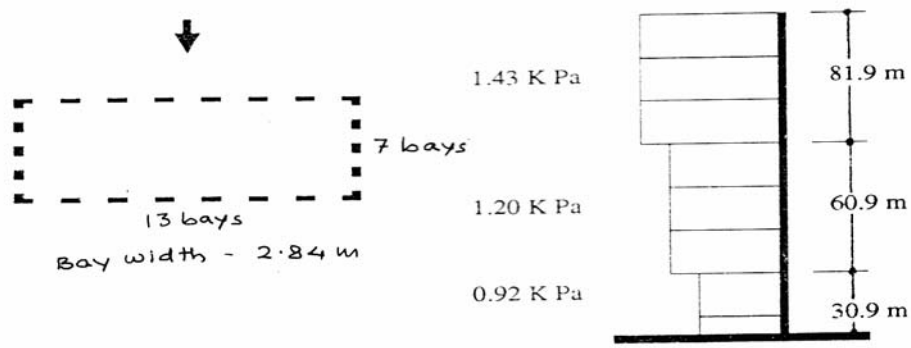


FIG. – 3 : GEOMETRY &LOADING IN A 49 STOREY STR.

One remarkable feature which can be extracted in the figure of the zone of negative shear lag. In fact the spandrel beam properties in the bottom one third storey height govern the spreading of this zone. If it is widely spread zone it is good from design optimization point of view and then it will arrest high shear lag which is at present 70 per cent at the base to some lower value. If dimensions are taken in such a way that it reduces to 30 per cent - 20 per cent maximum mobilization of material may be expected.

We may conclude that in bottom 1/3 rd storeys flange panel columns do not contribute much in sharing of axial stresses from corner columns. It means spandrel beams should be of larger dimensions in these storeys.

In the region of negative shear lag it can be seen that flange panel intermediate columns are more active in axial stress sharing

Here I tried to reduce the lateral displacement occurred due to wind load .For this I used a shear-panel technique. Different types of shear panel patterns have been used and the best one of them has been presented here.

The different types of shear panels have been provided up to 1/3rd height of the buildings. The thickness of the shear panel has been taken as 300mm.

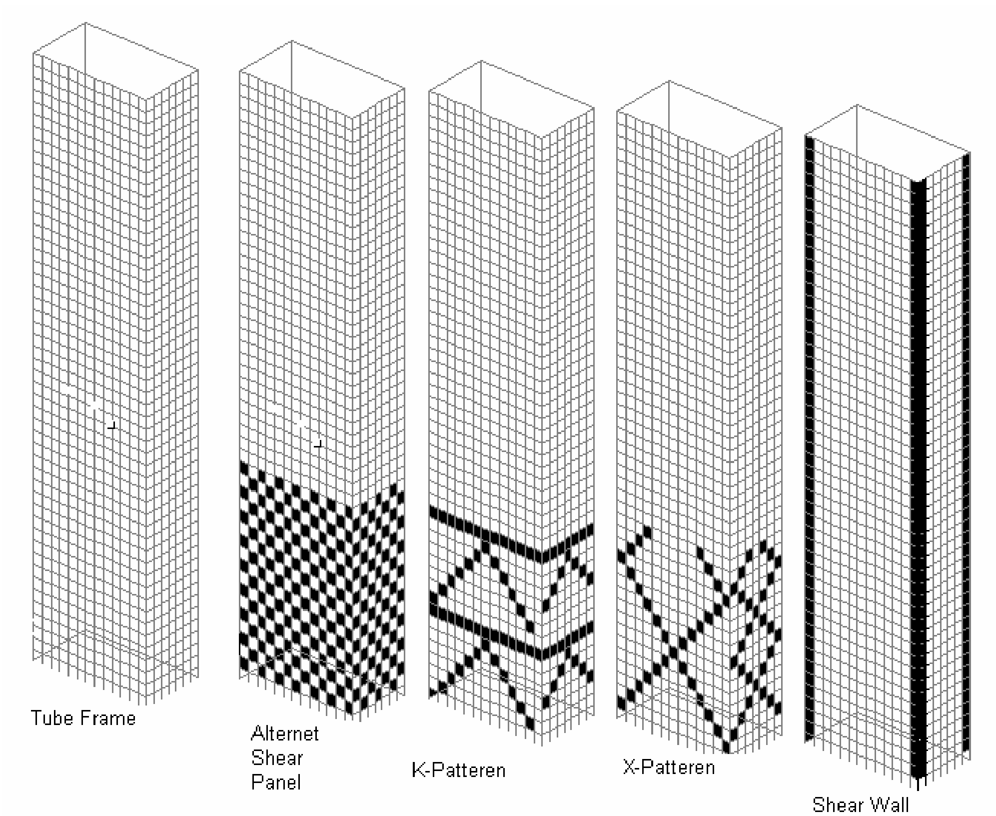


Fig. 4 Staggered Shear Panel Arrangement

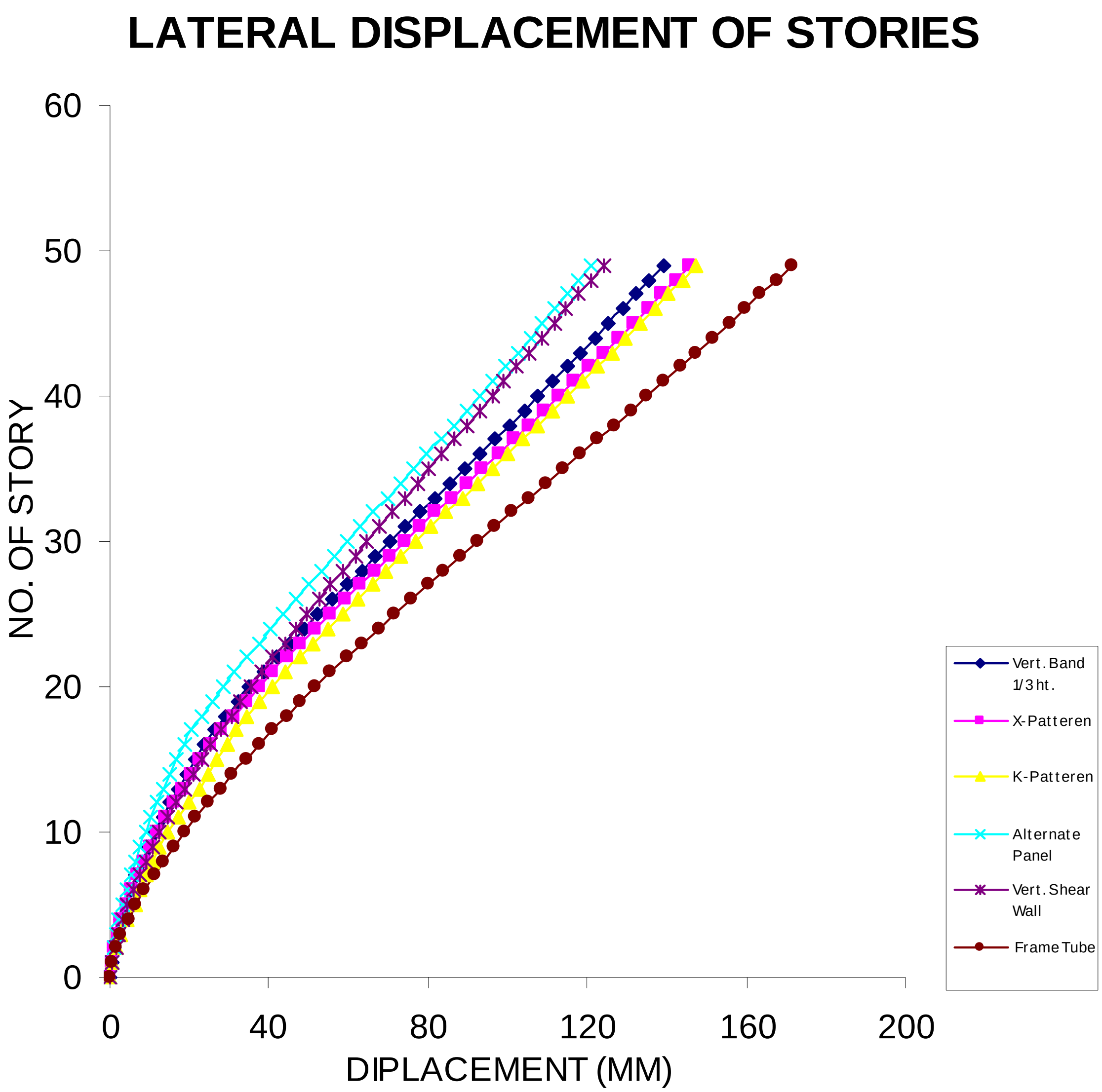


Fig. 5 Lateral displacement

Table 1:- Lateral Displacement

DISPLACEMENT OF STORY (MM)						
STORY	VERT.BAND 1/3	X-PATTEREN	K-PATTEREN	ALTERNATE PANAL	VERT.PANAL FULL-HT.	OPEN FRAME
	MM	MM	MM	MM	MM	MM
0	0	0	0	0	0	0
1	0.593	0.593	0.593	0.593	0.618	0.593
2	1.216	1.216	1.623	1.062	1.353	1.623
3	1.959	1.962	2.769	1.683	2.209	2.797
4	2.931	2.947	4.496	2.396	3.294	4.607
5	4.042	4.29	6.368	3.287	4.517	6.589
6	5.286	5.577	7.685	4.216	5.873	8.735
7	6.658	7.002	9.134	5.312	7.357	11.038
8	8.15	8.56	10.714	6.437	8.962	13.491
9	9.759	10.238	12.108	7.719	10.683	16.086
10	11.478	12.036	14.569	9.024	12.514	18.815
11	13.3	14.132	17.098	10.473	14.448	21.666
12	15.218	16.152	19.722	11.938	16.479	24.632
13	17.229	18.272	22.435	13.536	18.602	27.706
14	19.327	20.482	24.642	15.144	20.812	30.881
15	21.506	22.784	26.934	16.874	23.103	34.151
16	23.762	25.176	29.31	18.61	25.472	37.509
17	26.091	27.82	31.51	20.457	27.913	40.95
18	29.062	30.949	34.569	23.034	30.422	44.467
19	32.103	34.148	37.698	25.681	32.993	48.054
20	35.209	37.412	40.891	28.393	35.624	51.706
21	38.545	40.905	44.314	31.335	38.336	55.587
22	41.939	44.457	47.796	34.334	41.103	59.527
23	45.385	48.061	51.33	37.387	43.92	63.519
24	48.879	51.712	54.911	40.486	46.785	67.558
25	52.414	55.405	58.534	43.627	49.692	71.639
26	55.985	59.134	62.193	46.804	52.638	75.756
27	59.587	62.894	65.882	50.012	55.618	79.904
28	63.215	66.68	69.598	53.246	58.63	84.078
29	66.859	70.481	73.329	56.495	61.667	88.267
30	70.513	74.293	77.071	59.756	64.726	92.467
31	74.174	78.112	80.82	63.022	67.803	96.674
32	77.837	81.933	84.57	66.292	70.897	100.883
33	81.632	85.885	88.453	69.692	74.019	105.223

34	85.418	89.829	92.326	73.084	77.153	109.555
35	89.191	93.761	96.188	76.464	80.295	113.874
36	92.949	97.676	100.032	79.827	83.443	118.177
37	96.686	101.571	103.858	83.17	86.595	122.461
38	100.4	105.443	107.66	86.49	89.747	126.721
39	104.089	109.289	111.435	89.785	92.899	130.955
40	107.748	113.107	115.182	93.05	96.047	135.16
41	111.376	116.892	118.898	96.284	99.19	139.334
42	114.97	120.644	122.58	99.484	102.326	143.474
43	118.529	124.361	126.226	102.648	105.454	147.578
44	122.049	128.039	129.834	105.775	108.573	151.644
45	125.531	131.678	133.403	108.862	111.681	155.672
46	128.972	135.277	136.932	111.909	114.778	159.659
47	132.371	138.834	140.419	114.914	117.862	163.604
48	135.728	142.349	143.863	117.877	120.934	167.506
49	139.042	145.821	147.265	120.797	123.992	171.366

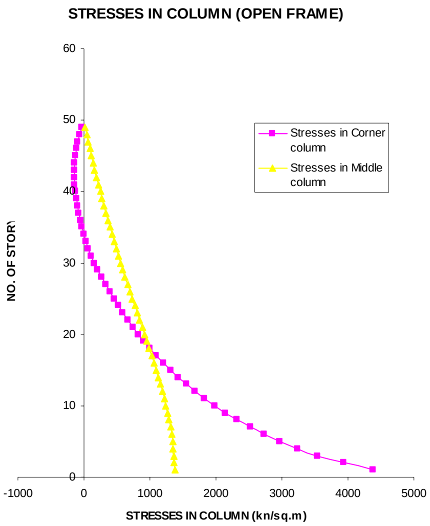


Fig. 6 Stresses in Columns

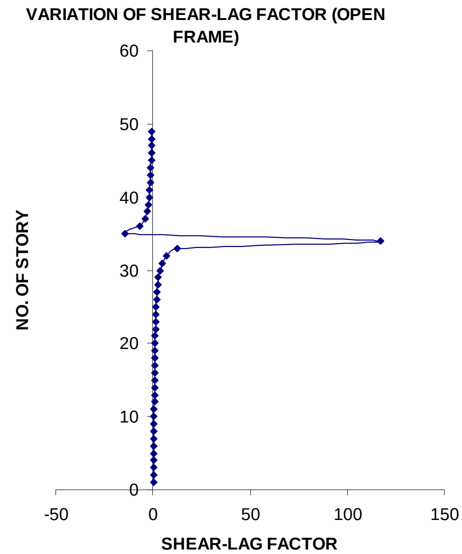


Fig. 7 Variation of Shear-Lag Factor

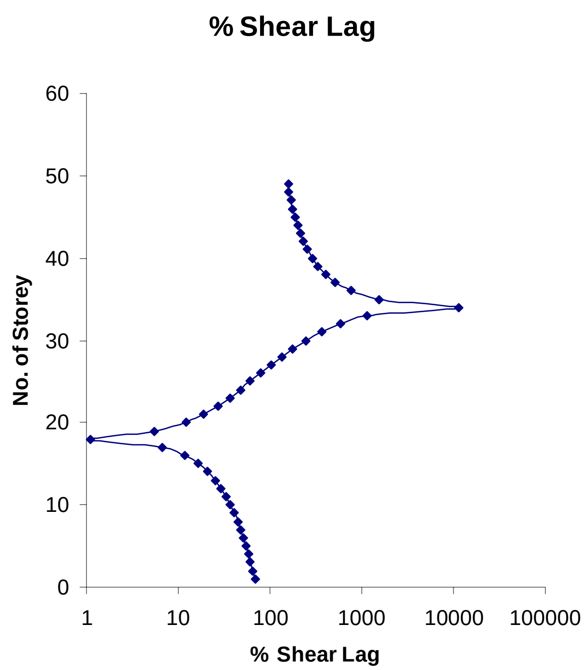


Fig8: Shear-Lag in Flange

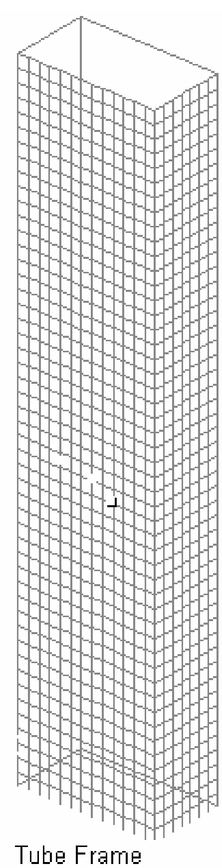


Fig. 9: Tube Frame

Table 2: Open Frame subjected to wind load

SHEAR LAG FACTOR					
NO. OF STORY	STRESSES IN CENTRAL COLUMN	STRESSES IN CORNER COLUMN	SHEAR-FACTOR	SHEAR-LAG	PERCENTAGE SHEAR-LAG
1	5883.527	1847.804	0.314064	0.685936	68.5936
2	5282.057	1841.728	0.348676	0.651324	65.13237
3	6315.707	2430.415	0.384821	0.615179	61.51793
4	5774.749	2414.193	0.41806	0.58194	58.19398
5	5292.361	2392.933	0.452148	0.547852	54.78515
6	4866.586	2366.878	0.486353	0.513647	51.36471
7	4484.711	2336.205	0.520926	0.479074	47.90736
8	4137.91	2301.126	0.556108	0.443892	44.38917
9	3819.538	2261.883	0.592188	0.407812	40.78124
10	3526.073	2218.73	0.629235	0.370765	37.07647
11	3255.144	2171.942	0.667234	0.332766	33.27662
12	3003.794	2121.803	0.706375	0.293625	29.36255
13	2769.43	2068.608	0.746944	0.253056	25.30562
14	2549.914	2012.655	0.789303	0.210697	21.0697
15	2343.455	1954.239	0.833914	0.166086	16.60864
16	2148.469	1893.658	0.881399	0.118601	11.86012
17	1963.418	1831.203	0.932661	0.067339	6.733916
18	1786.823	1767.174	0.989003	0.010997	1.099659
19	1614.236	1701.666	1.054162	0.054162	5.416217
20	1637.861	1836.194	1.121093	0.121093	12.10925
21	1484.808	1764.02	1.188046	0.188046	18.80461
22	1333.133	1690.958	1.268409	0.268409	26.8409
23	1186.429	1617.473	1.363312	0.363312	36.33116
24	1045.186	1543.78	1.477039	0.477039	47.70391
25	909.5842	1470.104	1.616237	0.616237	61.62374
26	779.5282	1396.641	1.79165	0.79165	79.16496
27	654.968	1323.581	2.020832	1.020832	102.0832
28	537.0552	1251.08	2.329518	1.329518	132.9518
29	426.7693	1179.284	2.763283	1.763283	176.3283
30	323.5746	1108.345	3.425314	2.425314	242.5314
31	224.8501	1038.153	4.617089	3.617089	361.7089
32	161.2113	1105.699	6.858694	5.858694	585.8694
33	83.38115	1032.657	12.38478	11.38478	1138.478
34	8.198998	960.8174	117.1872	116.1872	11618.72
35	-61.4822	890.4645	-14.4833	15.48328	1548.328

36	-124.554	821.6006	-6.59635	7.596355	759.6355
37	-180.285	754.2304	-4.18355	5.183554	518.3554
38	-228.142	688.3333	-3.01713	4.017126	401.7126
39	-267.68	623.873	-2.33067	3.330668	333.0668
40	-298.481	560.7946	-1.87883	2.878826	287.8826
41	-320.109	499.0278	-1.55893	2.558929	255.8929
42	-332.065	438.4859	-1.32048	2.320482	232.0482
43	-333.752	379.0619	-1.13576	2.135758	213.5758
44	-324.422	320.6421	-0.98835	1.98835	198.835
45	-303.119	263.1011	-0.86798	1.867979	186.7979
46	-268.609	206.2955	-0.76801	1.768015	176.8015
47	-219.173	150.0615	-0.68467	1.68467	168.467
48	-153.465	94.46266	-0.61553	1.615531	161.5531
49	-63.873	37.14026	-0.58147	1.581471	158.1471

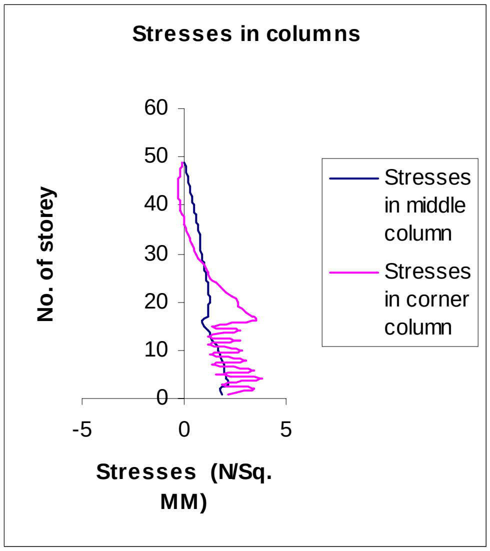


Fig. 11 Stresses in Columns

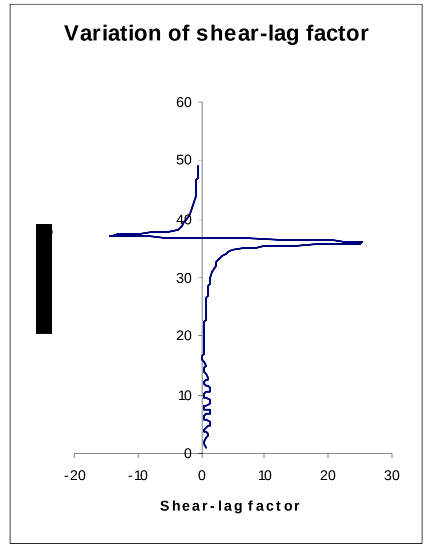


Fig. 12 Variation of shear-lag factor

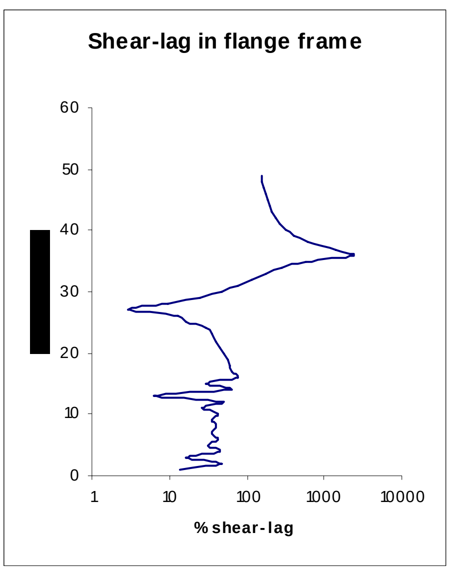


Fig. 13 Shear-lag in flange frame

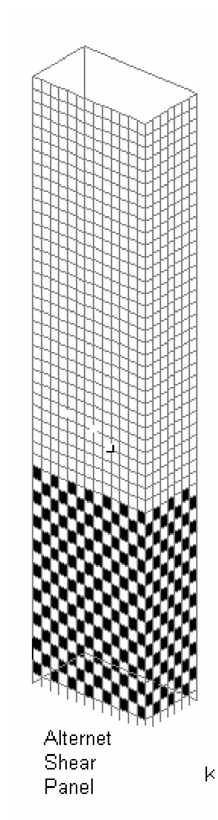
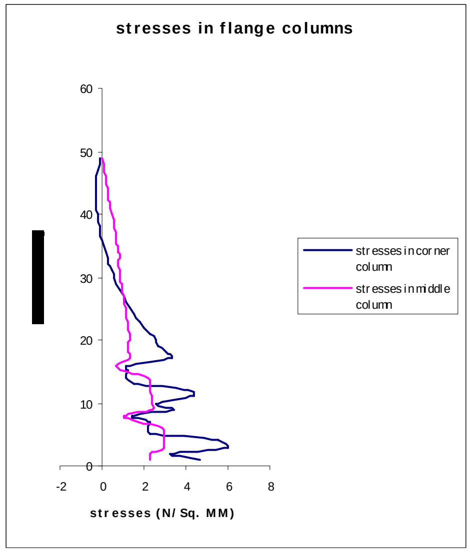


Fig. 11 Alternet Shear Panel

Table No. – 3 : SHEAR-LAG IN CLOUMN SUBJECTED TO WIND LOAD (ALTERNATE SHEAR PANEL)

SHEAR-LAG IN CLOUMN SUBJECTED TO WIND LOAD (ALTERNATE SHEAR PANEL)							
No. of storey	forces in middle column	Forces in corner column	Stresses in middle column	Stresses in corner column	Shear-lag factor	Shear-lag	% shear-lag
1	1356.112	1570.593	1.822241	2.110445	0.863439	0.136561	13.65605
2	1348.94	2567.516	1.812604	3.450035	0.525387	0.474613	47.46128
3	1208.62	1035.006	2.153635	1.844273	1.167742	0.167742	16.7742
4	1181.374	2157.351	2.105086	3.844175	0.547604	0.452396	45.2396
5	1156.337	885.835	2.060472	1.578466	1.305364	0.305364	30.53639
6	1114.182	1912.802	1.985356	3.408414	0.582487	0.417513	41.75132
7	1077.396	792.098	1.919808	1.411436	1.36018	0.36018	36.01802
8	1025.115	1732.82	1.826648	3.087705	0.591588	0.408412	40.84123
9	977.787	724.177	1.742315	1.290408	1.350204	0.350204	35.02044
10	915.593	1601.291	1.631491	2.853334	0.571784	0.428216	42.82157
11	858.353	680.781	1.529496	1.213081	1.260836	0.260836	26.08357
12	786.024	1529.779	1.400613	2.725907	0.513815	0.486185	48.61846
13	718.839	675.304	1.280896	1.203321	1.064467	0.064467	6.446726
14	637.932	1558.516	1.136728	2.777113	0.40932	0.59068	59.06799
15	561.387	794.557	1.000333	1.415818	0.706541	0.293459	29.34591
16	497.833	1957.014	0.887087	3.487195	0.254384	0.745616	74.5616
17	682.324	1888.645	1.21583	3.365369	0.361277	0.638723	63.8723
18	671.638	1689.623	1.196789	3.010732	0.397508	0.602492	60.24924
19	657.727	1483.759	1.172001	2.643904	0.443284	0.556716	55.67157
20	642.042	1307.601	1.283571	2.614156	0.491008	0.508992	50.89924
21	625.034	1160.2	1.249568	2.319472	0.53873	0.46127	46.12705
22	606.619	1026.919	1.212753	2.053017	0.590717	0.409283	40.92825
23	587.1	906.483	1.173731	1.812241	0.647668	0.352332	35.2332
24	566.649	796.697	1.132845	1.592757	0.711248	0.288752	28.87522
25	548.69	658.84	1.096941	1.317153	0.832812	0.167188	16.71878
26	523.478	602.71	1.046537	1.204938	0.86854	0.13146	13.14596
27	500.978	516.17	1.001555	1.031927	0.970568	0.029432	2.943216
28	477.998	436.11	0.955614	0.871871	1.096049	0.096049	9.604916
29	454.63	362.459	0.908896	0.724628	1.254294	0.254294	25.42936

30	430.968	294.524	0.861591	0.588812	1.46327	0.46327	46.32695
31	407.021	230.642	0.813717	0.4611	1.764731	0.764731	76.47306
32	383.587	176.098	0.766867	0.352055	2.178259	1.178259	117.8259
33	360.771	130.518	0.821428	0.297172	2.764147	1.764147	176.4147
34	337.878	87.339	0.769303	0.198859	3.868581	2.868581	286.8581
35	315.042	47.642	0.717309	0.108474	6.612695	5.612695	561.2695
36	292.307	11.753	0.665544	0.02676	24.87084	23.87084	2387.084
37	269.716	-20.136	0.614107	-0.04585	-13.3947	14.39472	1439.472
38	247.304	-47.897	0.563078	-0.10906	-5.16325	6.163246	616.3246
39	225.097	-71.428	0.512516	-0.16263	-3.15138	4.151383	415.1383
40	203.112	-90.623	0.462459	-0.20634	-2.24129	3.241285	324.1285
41	181.356	-105.36	0.412923	-0.23989	-1.7213	2.721298	272.1298
42	159.831	-115.481	0.363914	-0.26293	-1.38405	2.384046	238.4046
43	138.531	-120.779	0.315417	-0.275	-1.14698	2.146979	214.6979
44	117.44	-120.975	0.267395	-0.27544	-0.97078	1.970779	197.0779
45	96.54	-115.696	0.219809	-0.26342	-0.83443	1.834428	183.4428
46	75.805	-104.445	0.172598	-0.23781	-0.72579	1.725789	172.5789
47	55.197	-86.51	0.125676	-0.19697	-0.63804	1.638042	163.8042
48	34.763	-61.312	0.079151	-0.1396	-0.56699	1.566985	156.6985
49	13.656	-25.775	0.031093	-0.05869	-0.52982	1.529816	152.9816



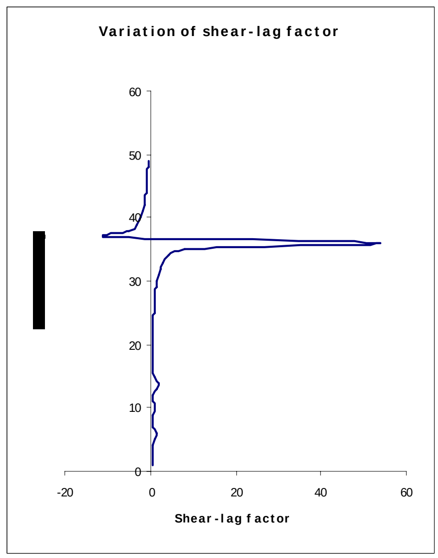


Fig 15: Stresses in column Fig 16: Variation of shear-lag factor

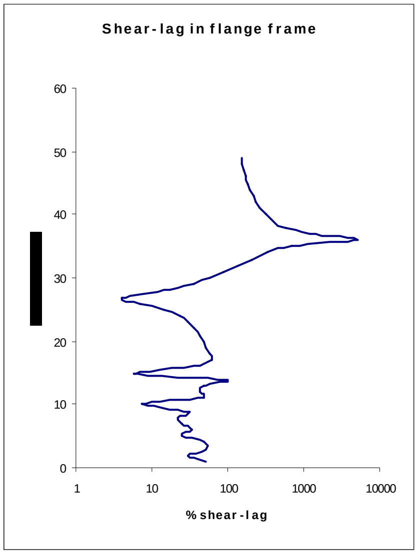


Fig 17: Shear-lag in flange frame

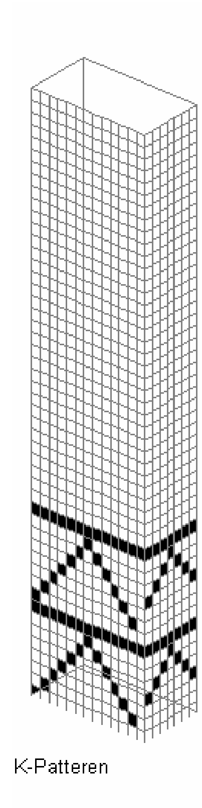
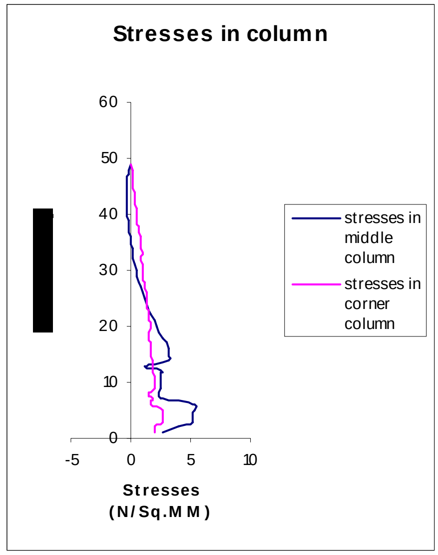


Fig 18: K-Pattern tube frame

Table No.-4 Stresses in flange subjected to wind force (K-pattern)

stresses in flange subjected to wind force (K-pattern)							
No. of storey	forces in corner column	forces in middle column	stresses in corner column	stresses in middle column	shear-lag factor	shear-lag	% shear-lag
1	3499.721	1684.104	4.702662	2.262972	0.481211	0.518789	51.87891
2	2398.17	1677.948	3.222481	2.2547	0.699679	0.300321	30.03215
3	3389.133	1668.54	6.039082	2.973165	0.492321	0.507679	50.76794
4	3126.406	1655.309	5.57093	2.949588	0.529461	0.470539	47.05393
5	1306.373	1635.32	2.327821	2.91397	1.251802	0.251802	25.18017
6	1206.784	1617.48	2.150364	2.882181	1.340323	0.340323	34.03227
7	1264.919	950.543	2.253954	1.693769	0.751466	0.248534	24.85345
8	784.197	610.384	1.397357	1.087641	0.778355	0.221645	22.16446
9	1933.969	1352.155	3.446132	2.4094	0.699161	0.300839	30.08394
10	1440.515	1335.993	2.566848	2.3806	0.927441	0.072559	7.255877
11	2481.001	1315.633	4.420886	2.344321	0.530283	0.469717	46.97169
12	2276.019	1291.253	4.055629	2.300878	0.56733	0.43267	43.26704
13	857.377	1261.596	1.527757	2.248033	1.47146	0.47146	47.146
14	643.307	1230.96	1.146306	2.193443	1.913488	0.913488	91.34877
15	720.906	679.938	1.284579	1.211579	0.943172	0.056828	5.682849
16	650.4	366.655	1.158945	0.653341	0.563738	0.436262	43.62623
17	1883.852	736.059	3.356828	1.311581	0.39072	0.60928	60.92798
18	1684.713	718.954	3.001983	1.281101	0.426752	0.573248	57.32484
19	1472.085	700.135	2.623102	1.247568	0.475608	0.524392	52.43923
20	1291.323	680.46	2.581613	1.360376	0.526948	0.473052	47.30521
21	1141.384	660.092	2.281855	1.319656	0.578326	0.421674	42.1674
22	1007.224	638.666	2.013643	1.276821	0.634085	0.365915	36.59146
23	886.919	616.39	1.773129	1.232287	0.694979	0.305021	30.50211
24	777.862	593.385	1.555102	1.186295	0.762841	0.237159	23.7159
25	668.32	572.365	1.336106	1.144272	0.856424	0.143576	14.35764
26	586.16	545.629	1.171851	1.090822	0.930853	0.069147	6.914665
27	500.904	521.074	1.001407	1.041731	1.040267	0.040267	4.02672
28	422.125	496.189	0.843912	0.991981	1.175455	0.175455	17.54551
29	349.715	471.056	0.69915	0.941735	1.346971	0.346971	34.69711

30	282.959	445.764	0.565692	0.891172	1.575366	0.575366	57.5366
31	220.189	420.305	0.440202	0.840274	1.908837	0.908837	90.88374
32	166.66	395.512	0.333187	0.790708	2.373167	1.373167	137.3167
33	122	371.489	0.277778	0.845831	3.044992	2.044992	204.4992
34	79.671	347.49	0.1814	0.791189	4.361562	3.361562	336.1562
35	40.755	323.645	0.092794	0.736897	7.941234	6.941234	694.1234
36	5.583	299.987	0.012712	0.683031	53.73222	52.73222	5273.222
37	-25.645	276.551	-0.05839	0.62967	-10.7838	11.78382	1178.382
38	-52.798	253.365	-0.12021	0.576878	-4.79876	5.798761	579.8761
39	-75.765	230.446	-0.17251	0.524695	-3.04159	4.041589	404.1589
40	-94.439	207.804	-0.21503	0.473142	-2.2004	3.200404	320.0404
41	-108.69	185.441	-0.24747	0.422224	-1.70615	2.706146	270.6146
42	-118.356	163.35	-0.26948	0.371926	-1.38016	2.380158	238.0158
43	-123.226	141.521	-0.28057	0.322224	-1.14847	2.148467	214.8467
44	-123.018	119.932	-0.2801	0.273069	-0.97491	1.974914	197.4914
45	-117.354	98.559	-0.2672	0.224406	-0.83984	1.839844	183.9844
46	-105.732	77.373	-0.24074	0.176168	-0.73178	1.731784	173.1784
47	-87.438	56.33	-0.19908	0.128256	-0.64423	1.644228	164.4228
48	-61.891	35.474	-0.14092	0.08077	-0.57317	1.573169	157.3169
49	-25.991	13.937	-0.05918	0.031733	-0.53622	1.536224	153.6224



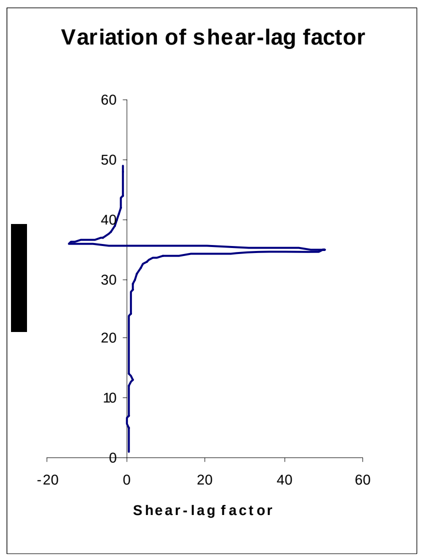


Fig 19: Stresses in column

Fig 20: Variation of shear-lag factor

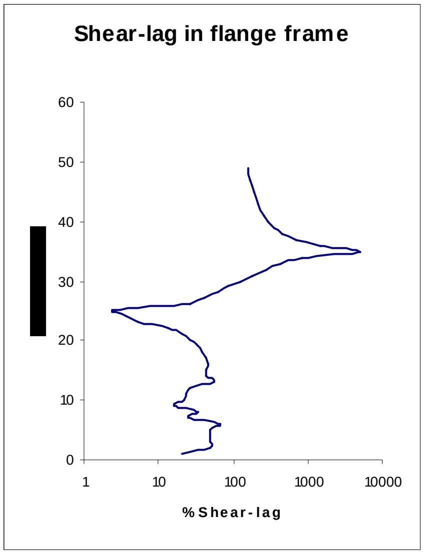


Fig 21: Shear lag in flange frame

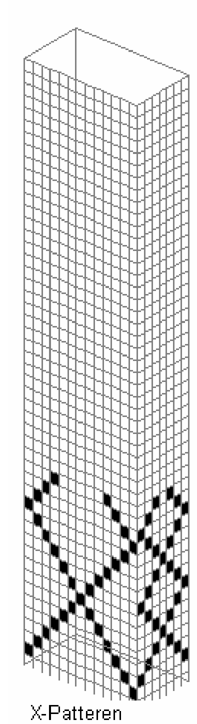
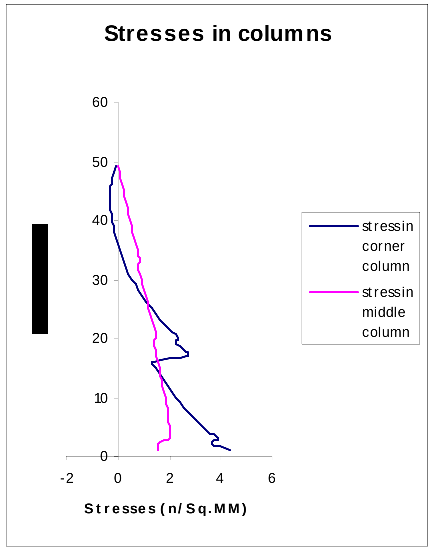


Fig 22: X-Pattern tube frame

Table No. – 5 : FLANGE SUBJECTED TO WIND LOAD (X-PATTEREN)

FLANGE SUBJECTED TO WIND LOAD (X-PATTEREN)							
No. of storey	Forces in corner column	Forces in middle column	Stresses in corner column	Stresses inmiddle column	Shear-lag factor	Shear-lag	% Shear-lag
1	1928.685	1537.759	2.591622	2.066325	0.79731	0.20269	20.26904
2	2967.497	1533.08	3.987499	2.060038	0.516624	0.483376	48.33761
3	2945.045	1526.326	5.247764	2.719754	0.518269	0.481731	48.17308
4	2943.768	1515.159	5.245488	2.699856	0.514701	0.485299	48.52995
5	2959.861	1508.223	5.274164	2.687496	0.509559	0.490441	49.04413
6	3019.648	981.386	5.380699	1.748728	0.325	0.675	67.49999
7	1405.218	1046.671	2.503952	1.865059	0.744846	0.255154	25.5154
8	1293.373	844.96	2.304656	1.505631	0.6533	0.3467	34.67004
9	1369.594	1142.265	2.440474	2.035397	0.834017	0.165983	16.59828
10	1411.974	1107.757	2.515991	1.973908	0.784545	0.215455	21.54551
11	1419.195	1083.148	2.528858	1.930057	0.763213	0.236787	23.67871
12	1439.316	1055.508	2.564711	1.880805	0.73334	0.26666	26.666
13	653.354	1027.59	1.164209	1.831058	1.572792	0.572792	57.27921
14	1746.696	998.901	3.112431	1.779938	0.57188	0.42812	42.81197
15	1740.809	969.608	3.10194	1.727741	0.556987	0.443013	44.3013
16	1743.806	939.739	3.107281	1.674517	0.538901	0.461099	46.10989
17	1640.155	909.351	2.922586	1.620369	0.55443	0.44557	44.55701
18	1452.066	878.501	2.587431	1.565397	0.605001	0.394999	39.49993
19	1268.417	847.156	2.260187	1.509544	0.667884	0.332116	33.21155
20	1113.441	816.156	2.225992	1.631659	0.733003	0.266997	26.69966
21	985.218	785.576	1.969648	1.570524	0.797363	0.202637	20.26374
22	869.036	754.644	1.737377	1.508685	0.868369	0.131631	13.16309
23	763.895	723.507	1.527179	1.446435	0.947129	0.052871	5.287114
24	667.857	692.218	1.33518	1.383882	1.036476	0.036476	3.647637
25	618.48	634.25	1.236465	1.267993	1.025498	0.025498	2.5498
26	497.505	629.43	0.994612	1.258357	1.265173	0.265173	26.51732
27	421.153	598.054	0.841969	1.19563	1.42004	0.42004	42.00397
28	350.352	566.77	0.700424	1.133087	1.617716	0.617716	61.77159
29	285.127	535.634	0.570026	1.07084	1.87858	0.87858	87.85804
30	224.86	504.709	0.44954	1.009014	2.244548	1.244548	124.4548

31	167.957	473.951	0.33578	0.947523	2.821859	1.821859	182.1859
32	119.797	444.312	0.239498	0.888269	3.708874	2.708874	270.8874
33	80.028	415.903	0.182213	0.946956	5.196969	4.196969	419.6969
34	42.097	387.808	0.095849	0.882987	9.212248	8.212248	821.2248
35	7.154	360.146	0.016289	0.820005	50.34191	49.34191	4934.191
36	-24.411	332.93	-0.05558	0.758037	-13.6385	14.63852	1463.852
37	-52.351	306.174	-0.1192	0.697117	-5.84848	6.848484	684.8484
38	-76.496	279.884	-0.17417	0.637259	-3.65881	4.658806	465.8806
39	-96.7	254.057	-0.22017	0.578454	-2.62727	3.62727	362.727
40	-112.823	228.683	-0.25688	0.520681	-2.02692	3.026918	302.6918
41	-124.709	203.747	-0.28395	0.463905	-1.63378	2.633779	263.3779
42	-132.171	179.224	-0.30094	0.408069	-1.356	2.356001	235.6001
43	-134.975	155.083	-0.30732	0.353103	-1.14898	2.148976	214.8976
44	-132.817	131.29	-0.30241	0.29893	-0.9885	1.988503	198.8503
45	-125.299	107.801	-0.28529	0.245449	-0.86035	1.86035	186.035
46	-111.902	84.572	-0.25479	0.192559	-0.75577	1.755768	175.5768
47	-91.89	61.542	-0.20922	0.140123	-0.66974	1.669736	166.9736
48	-64.68	38.747	-0.14727	0.088222	-0.59906	1.599057	159.9057
49	-27.042	15.229	-0.06157	0.034674	-0.56316	1.563161	156.3161



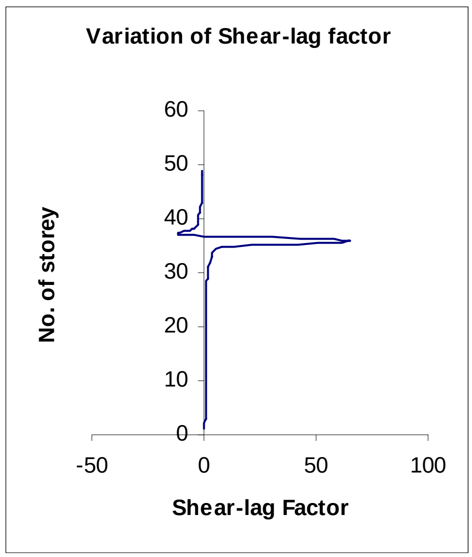


Fig 23: Stresses in columns

Fig 24: Variation of Shear-lag factor

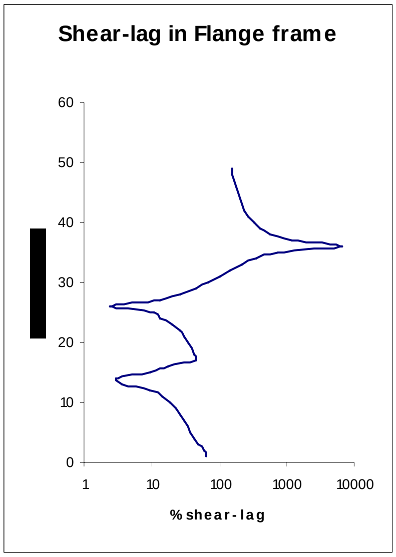


Fig 25: Shear-lag in Flange frame

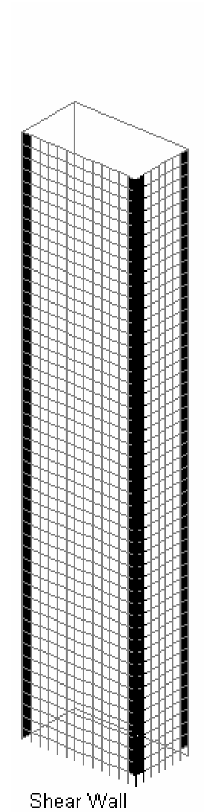


Fig 26: Shear Wall

Table No. -6: FLANGE SUBJECTED TO WIND LOAD (SHEAR WALL)

FLANGE SUBJECTED TO WIND LOAD (SHEAR WALL)							
No. of storey	Forces in corner column	Forces in middle column	Stresses in corner column	Stresses in middle column	Shear-lag factor	Shear-lag	% Shear-lag
1	3224.927	1157.504	4.333414	1.555367	0.358924	0.641076	64.10759
2	2753.848	1153.169	3.700414	1.549542	0.418748	0.581252	58.12518
3	2185.38	1146.805	3.89412	2.043487	0.524762	0.475238	47.52377
4	1982.534	1138.169	3.532669	2.028099	0.574098	0.425902	42.59019
5	1826.91	1126.914	3.255364	2.008043	0.616842	0.383158	38.31584
6	1694.084	1113.213	3.018681	1.98363	0.657118	0.342882	34.28821
7	1576.467	1097.207	2.8091	1.955109	0.695991	0.304009	30.40089
8	1469.025	1079.061	2.61765	1.922774	0.734542	0.265458	26.54577
9	1367.72	1058.951	2.437135	1.88694	0.774245	0.225755	22.57545
10	1271.454	1037.062	2.265599	1.847937	0.81565	0.18435	18.43496
11	1179.556	1013.58	2.101846	1.806094	0.859289	0.140711	14.07106
12	1089.444	988.692	1.941276	1.761746	0.90752	0.09248	9.24802
13	999.353	962.578	1.780743	1.715214	0.963201	0.036799	3.679881
14	907.945	935.409	1.617864	1.666801	1.030249	0.030249	3.024853
15	830.152	907.348	1.479244	1.6168	1.09299	0.09299	9.29902
16	747.244	878.543	1.331511	1.565472	1.175711	0.175711	17.5711
17	1551.825	849.131	2.765191	1.513063	0.547182	0.452818	45.28178
18	1428.936	819.246	2.546215	1.459811	0.573326	0.426674	42.66741
19	1292.683	788.914	2.303427	1.405763	0.610292	0.389708	38.97081
20	1165.723	758.999	2.330514	1.517391	0.651097	0.348903	34.89028
21	1050.914	729.612	2.100988	1.458641	0.694264	0.305736	30.57358
22	941.961	700.028	1.883169	1.399496	0.74316	0.25684	25.68397
23	839.607	670.402	1.678543	1.340268	0.798471	0.201529	20.15288
24	743.427	640.787	1.486259	1.281062	0.861937	0.138063	13.80633
25	684.75	608.64	1.368952	1.216793	0.88885	0.11115	11.11501
26	567.78	581.8	1.135106	1.163135	1.024693	0.024693	2.469266
27	487.461	552.519	0.974532	1.104596	1.133463	0.133463	13.3463
28	412.313	523.432	0.824296	1.046445	1.269502	0.269502	26.95016
29	342.596	494.573	0.684918	0.98875	1.443604	0.443604	44.36041

30	277.862	465.983	0.555502	0.931593	1.67703	0.67703	67.70303
31	216.666	437.602	0.433159	0.874854	2.019708	1.019708	101.9708
32	164.144	410.292	0.328157	0.820256	2.499586	1.499586	149.9586
33	120.046	384.143	0.273329	0.874643	3.199965	2.199965	219.9965
34	78.169	358.297	0.17798	0.815795	4.58362	3.58362	358.362
35	39.602	332.857	0.090168	0.757871	8.405055	7.405055	740.5055
36	4.696	307.824	0.010692	0.700874	65.55026	64.55026	6455.026
37	-26.33	283.205	-0.05995	0.64482	-10.756	11.75598	1175.598
38	-53.328	258.998	-0.12142	0.589704	-4.8567	5.856698	585.6698
39	-76.179	235.201	-0.17345	0.535521	-3.08748	4.087478	408.7478
40	-94.764	211.801	-0.21577	0.482243	-2.23504	3.235037	323.5037
41	-108.946	188.782	-0.24806	0.429832	-1.7328	2.732803	273.2803
42	-118.559	166.124	-0.26994	0.378242	-1.40119	2.401193	240.1193
43	-123.386	143.798	-0.28093	0.327409	-1.16543	2.165432	216.5432
44	-123.143	121.774	-0.28038	0.277263	-0.98888	1.988883	198.8883
45	-117.45	100.014	-0.26742	0.227719	-0.85155	1.851545	185.1545
46	-105.803	78.479	-0.2409	0.178686	-0.74175	1.741746	174.1746
47	-87.487	57.116	-0.1992	0.130046	-0.65285	1.652851	165.2851
48	-61.918	35.963	-0.14098	0.081883	-0.58082	1.580817	158.0817
49	-25.998	14.133	-0.05919	0.032179	-0.54362	1.543619	154.3619

Numerical Problem- 2

A same model has been used here which we had used in the last example. But the new part is the internal columns are also taken in to consideration

Stories	Column (m*m)
1-2	1.22 * 0.61
3-19	1.22 * 0.46
22-31	1.22 * 0.41
32-49	1.22 * 0.36
Internal columns	0.75 * 0.75

Stories	Beams (m * m)
1	0.76 * 0.61
2-49	0.38 * 0.99

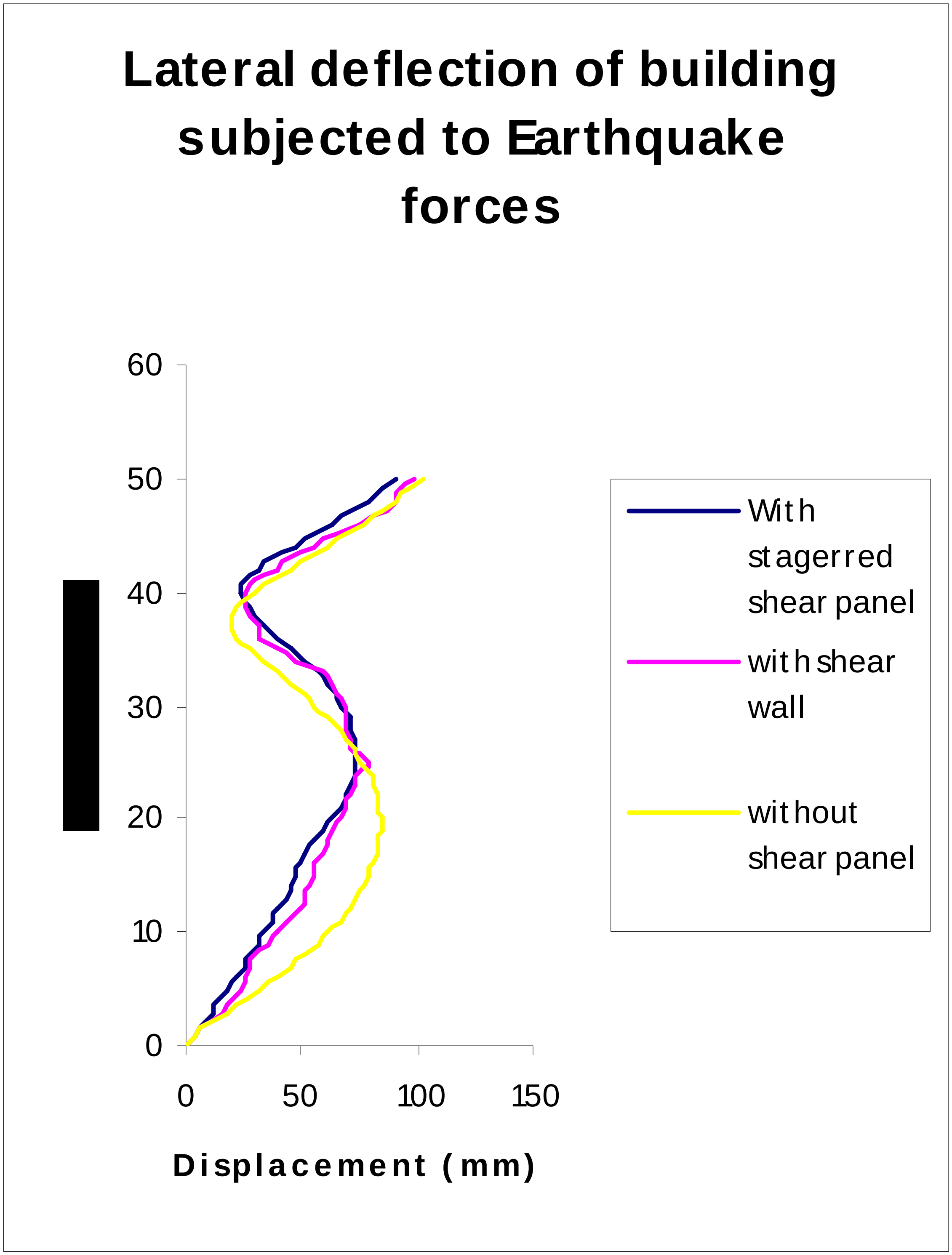


Fig no. 27: Lateral displacement of building subjected to Earthquake forces

Table No. – 7: LATERAL DISPLACEMENT OF THE BUILDING (EARTHQUAKE FORCES)

LATERAL DISPLACEMENT OF THE BUILDING (EARTHQUAKE FORCES)			
No. of storey	Building with stagerred shear panel	Building with shear wall	Building without shear panel
0	0	0	0
1	4.246	4.021	3.408
2	7.78	9.81	10.396
3	11.116	15.93	17.612
4	14.341	19.98	25.178
5	18.046	22.83	32.368
6	21.243	24.87	39.152
7	24.934	26.8	45.522
8	28.033	29.84	51.466
9	31.532	34.92	56.934
10	34.419	38.54	61.91
11	37.634	42.85	66.414
12	40.266	48.62	70.435
13	43.136	51.02	73.962
14	45.431	53.81	76.982
15	47.901	54.87	79.487
16	49.746	55.6	81.467
17	52.069	58.95	82.911
18	56.002	60.58	83.824
19	59.995	63.59	84.217
20	63.588	67.9	84.097
21	66.78	68.24	83.468
22	69.403	70.85	82.312
23	71.425	73.51	80.638
24	72.822	74.58	78.455
25	73.574	78.53	75.773
26	73.683	70.89	72.615
27	73.151	71.98	69.005
28	71.99	68.95	64.969
29	70.209	69.48	60.533

30	67.771	68.43	55.701
31	64.641	64.78	50.487
32	60.837	63.95	44.949
33	56.305	59	39.044
34	51.214	48.26	33.08
35	45.685	38.65	27.393
36	39.887	32	22.62
37	34.093	30.65	19.877
38	28.811	27.95	20.371
39	24.951	25.96	24.147
40	23.783	25.94	30.131
41	26.1	29.82	37.333
42	31.369	38.91	45.152
43	38.468	45.85	53.235
44	46.504	54.98	61.345
45	54.896	64.58	69.31
46	63.271	75.95	77.005
47	71.303	87.62	84.294
48	78.665	90.21	91.017
49	85.086	93.51	97.051
50	90.406	98.021	102.331

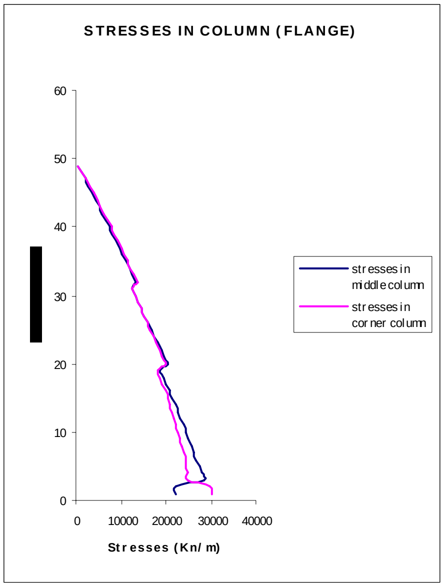


Fig 28: Stresses in column

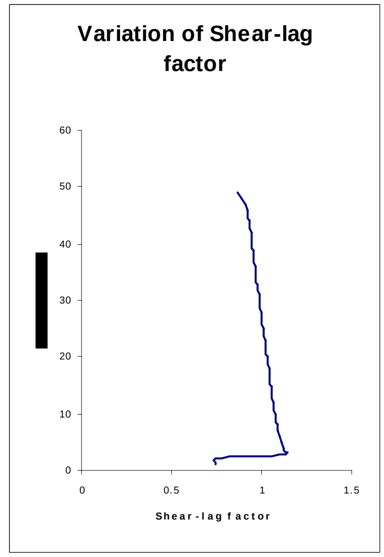


Fig 29: Variation of shear-lag factor

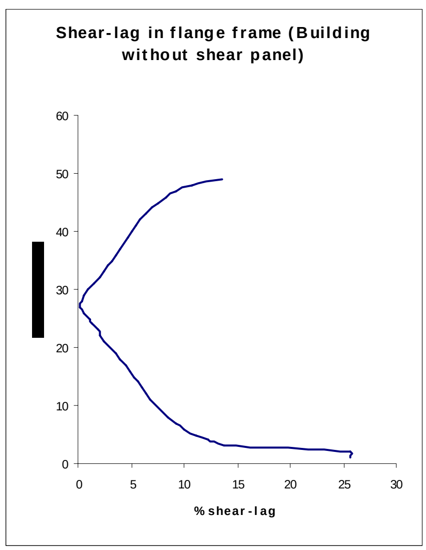


Fig 30: Shear lag in flange frame

Table No. – 8: **SHEAR-LAG EFFECT IN FLANGE (FULL BUILDING WITH-OUT SHEAR PANAL)**

SHEAR-LAG EFFECT IN FLANGE (FULL BUILDING WITH-OUT SHEAR PANAL)							
NO. OF STOREY	FORCES IN CENTRAL COLUMN	FORCES IN CORNER COLUMN	STRESSES IN CENTRAL COLUMN	STRESSES IN CORNER COLUMN	SHEAR LAG FACTOR	SHEAR-LAG	% SHEAR-LAG
1.00	16,669.14	14,122.47	22,398.73	30,097.73	0.74	0.26	25.58
2.00	16,374.51	14,133.08	22,002.83	29,565.75	0.74	0.26	25.58
3.00	16,014.03	14,076.34	28,535.33	25,082.57	1.14	0.14	13.77
4.00	15,687.38	13,973.45	27,953.27	24,899.22	1.12	0.12	12.27
5.00	15,360.80	13,832.02	27,371.35	24,647.22	1.11	0.11	11.05
6.00	15,035.17	13,661.06	26,791.10	24,342.59	1.10	0.10	10.06
7.00	14,709.24	13,466.95	26,210.33	23,996.71	1.09	0.09	9.22
8.00	14,382.42	13,254.28	25,627.98	23,617.75	1.09	0.09	8.51
9.00	14,054.20	13,026.32	25,043.12	23,211.54	1.08	0.08	7.89
10.00	13,724.13	12,785.44	24,454.96	22,782.33	1.07	0.07	7.34
11.00	13,391.79	12,533.38	23,862.77	22,333.17	1.07	0.07	6.85
12.00	13,056.74	12,271.38	23,265.75	21,866.32	1.06	0.06	6.40
13.00	12,718.48	12,000.37	22,663.01	21,383.40	1.06	0.06	5.98
14.00	12,376.41	11,720.98	22,053.47	20,885.57	1.06	0.06	5.59
15.00	12,029.78	11,433.76	21,435.82	20,373.77	1.05	0.05	5.21

16.00	11,677.68	11,139.16	20,808.40	19,848.82	1.05	0.05	4.83
17.00	11,318.88	10,837.56	20,169.06	19,311.41	1.04	0.04	4.44
18.00	10,952.14	10,529.61	19,515.58	18,762.67	1.04	0.04	4.01
19.00	10,573.89	10,215.09	18,841.57	18,202.23	1.04	0.04	3.51
20.00	10,192.57	9,899.63	20,376.99	19,791.34	1.03	0.03	2.96
21.00	9,833.43	9,590.58	19,658.99	19,173.49	1.03	0.03	2.53
22.00	9,478.99	9,278.18	18,950.40	18,548.94	1.02	0.02	2.16
23.00	9,127.95	8,962.89	18,248.59	17,918.62	1.02	0.02	1.84
24.00	8,742.64	8,628.00	17,478.30	17,249.10	1.01	0.01	1.33
25.00	8,394.46	8,307.00	16,782.21	16,607.36	1.01	0.01	1.05
26.00	8,010.71	7,967.28	16,015.01	15,928.20	1.01	0.01	0.55
27.00	7,662.47	7,641.77	15,318.82	15,277.43	1.00	0.00	0.27
28.00	7,277.12	7,297.79	14,548.41	14,589.74	1.00	0.00	0.28
29.00	6,926.09	6,968.76	13,846.64	13,931.96	0.99	0.01	0.61
30.00	6,572.62	6,638.92	13,139.98	13,272.52	0.99	0.01	1.00
31.00	6,212.85	6,306.61	12,420.73	12,608.17	0.99	0.01	1.49
32.00	5,856.73	5,979.07	13,334.99	13,613.54	0.98	0.02	2.05
33.00	5,523.19	5,663.21	12,575.57	12,894.37	0.98	0.02	2.47

34.00	5,193.42	5,346.47	11,824.73	12,173.20	0.97	0.03	2.86
35.00	4,867.19	5,029.61	11,081.94	11,451.75	0.97	0.03	3.23
36.00	4,543.21	4,712.10	10,344.28	10,728.82	0.96	0.04	3.58
37.00	4,220.52	4,393.46	9,609.55	10,003.32	0.96	0.04	3.94
38.00	3,898.28	4,073.16	8,875.87	9,274.03	0.96	0.04	4.29
39.00	3,575.77	3,750.62	8,141.56	8,539.67	0.95	0.05	4.66
40.00	3,252.35	3,425.27	7,405.17	7,798.88	0.95	0.05	5.05
41.00	2,927.43	3,096.49	6,665.37	7,050.29	0.95	0.05	5.46
42.00	2,600.48	2,763.65	5,920.94	6,292.45	0.94	0.06	5.90
43.00	2,270.99	2,426.06	5,170.74	5,523.81	0.94	0.06	6.39
44.00	1,938.49	2,082.98	4,413.69	4,742.68	0.93	0.07	6.94
45.00	1,602.52	1,733.60	3,648.71	3,947.17	0.92	0.08	7.56
46.00	1,262.60	1,376.97	2,874.77	3,135.18	0.92	0.08	8.31
47.00	918.23	1,011.88	2,090.69	2,303.90	0.91	0.09	9.25
48.00	569.37	638.16	1,296.39	1,453.00	0.89	0.11	10.78
49.00	210.85	244.26	480.08	556.14	0.86	0.14	13.68

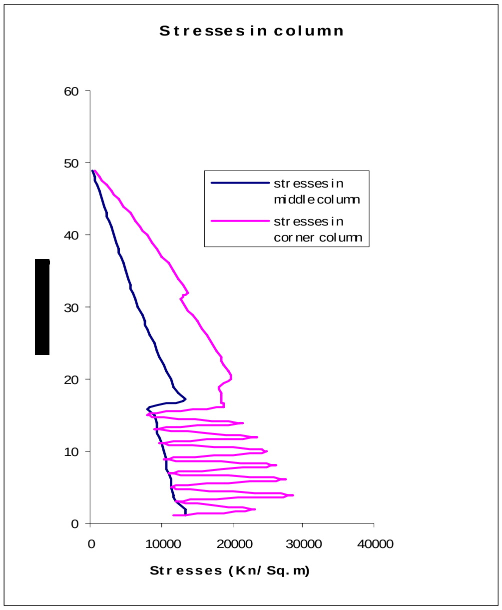


Fig 31: Stresses in column

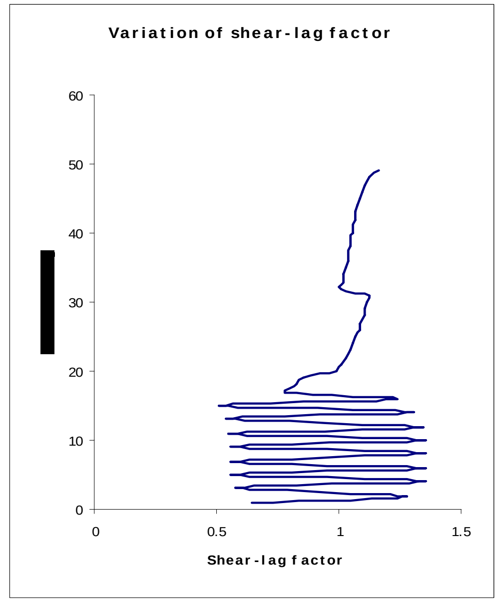


Fig 32: Variation of shear lag factor

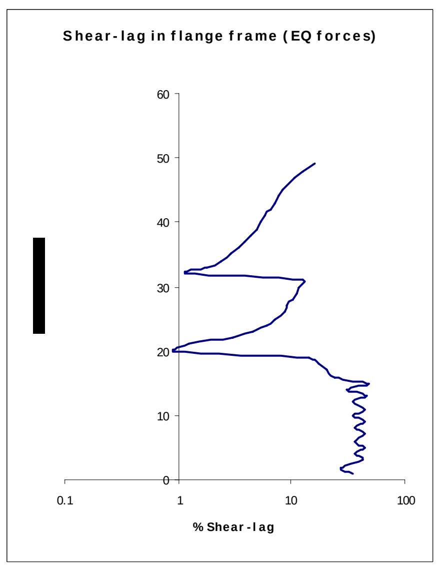


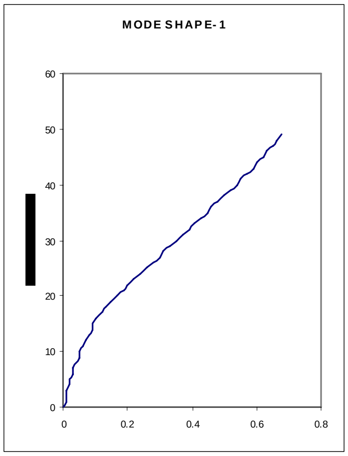
Fig 33: Shear lag in flange frame

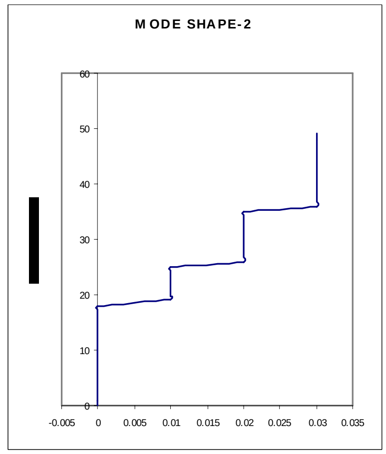
Table 9: FLANGE SUBJECTED TO EQ FORCES (WITH STAGGERED SHEAR PANEL)

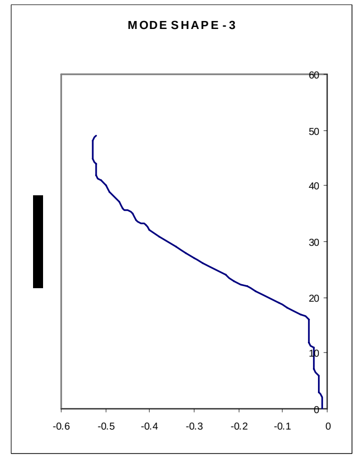
FLANGE SUBJECTED TO EQ FORCES (WITH STAGGERED SHEAR PANEL)							
NO. OF STORY	FORCES IN CORNER COLUMN	FORCES IN CENTRAL COLUMN	STRESSES IN CORNER COLUMN	STRESSES IN CENTRAL COMUN	SHEAR-LAG FACTOR	SHEAR-LAG	% SHEAR-LAG
1	8759.665	13576.67	11770.58	18243.31	0.6452	0.3548	35.48004
2	17243.1	13511.65	23169.98	18155.94	1.276165	0.276165	27.61653
3	6873.889	11997.18	12248.55	21377.72	0.572959	0.427041	42.70412
4	16069.89	11823.85	28634.87	21068.88	1.359108	0.359108	35.91076
5	6445.005	11578.33	11484.33	20631.38	0.556644	0.443356	44.33562
6	15424.97	11353.55	27485.7	20230.85	1.358603	0.358603	35.86031
7	6173.965	11100.63	11001.36	19780.16	0.556182	0.443818	44.38183
8	14765.44	10863.91	26310.48	19358.35	1.359128	0.359128	35.91282
9	5888.486	10600.73	10492.67	18889.39	0.555479	0.444521	44.45206
10	14023.27	10352.67	24988.01	18447.38	1.354556	0.354556	35.45557
11	5562.043	10077.48	9910.982	17957.02	0.551928	0.448072	44.80721
12	13169.53	9817.834	23466.73	17494.36	1.341388	0.341388	34.13884
13	5171.023	9527.892	9214.225	16977.71	0.542725	0.457275	45.72752
14	12138.22	9250.676	21629.05	16483.74	1.312145	0.312145	31.21445
15	4580.2	8941.224	8161.44	15932.33	0.512256	0.487744	48.77435
16	10555.93	8502.213	18809.56	15150.06	1.24155	0.24155	24.15504
17	10356.49	13091.03	18454.18	23326.85	0.791113	0.208887	20.88867
18	10317.54	12457.33	18384.78	22197.67	0.828231	0.171769	17.17695
19	10173.34	11855.4	18127.82	21125.09	0.858118	0.141882	14.18818
20	9970.769	11290.9	19933.56	20119.21	0.990773	0.009227	0.922721
21	9730.261	10783.35	19452.74	19214.81	1.012383	0.012383	1.238253
22	9459.271	10301.52	18910.98	18356.24	1.030221	0.030221	3.022074
23	9166.765	9841.328	18326.2	17536.22	1.045048	0.045048	4.504831
24	8842.031	9361.944	17676.99	16682.01	1.059644	0.059644	5.964397
25	8522.674	8932.364	17038.53	15916.54	1.070492	0.070492	7.049203
26	8178.901	8448.381	16351.26	15054.14	1.086164	0.086164	8.616408
27	7845.594	8068.152	15684.91	14376.61	1.091002	0.091002	9.100247
28	7491.434	7629.65	14976.88	13595.24	1.101626	0.101626	10.16264
29	7150.787	7230.865	14295.86	12884.65	1.109526	0.109526	10.95262

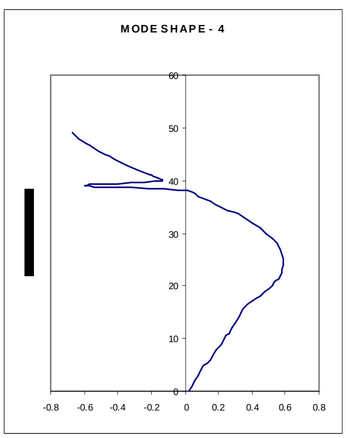
30	6808.522	6835.951	13611.6	12180.95	1.117449	0.117449	11.74494
31	6463.374	6439.339	12921.58	11474.23	1.126139	0.126139	12.61389
32	6123.634	6052.094	13942.7	13779.81	1.011821	0.011821	1.18207
33	5796.47	5693.064	13197.79	12962.35	1.018164	0.018164	1.816351
34	5468.665	5340.785	12451.42	12160.26	1.023944	0.023944	2.394405
35	5141.147	4994.854	11705.71	11372.62	1.029289	0.029289	2.928874
36	4813.438	4653.607	10959.56	10595.64	1.034346	0.034346	3.434562
37	4485.087	4315.774	10211.95	9826.444	1.039231	0.039231	3.92312
38	4155.554	3980.24	9461.644	9062.477	1.044046	0.044046	4.404609
39	3824.259	3646.033	8707.329	8301.532	1.048882	0.048882	4.888217
40	3490.589	3312.292	7947.607	7541.648	1.053829	0.053829	5.382889
41	3153.901	2978.241	7181.013	6781.059	1.058981	0.058981	5.898112
42	2813.522	2643.173	6406.015	6018.153	1.064449	0.064449	6.444868
43	2468.73	2306.43	5620.97	5251.434	1.070368	0.070368	7.036849
44	2118.741	1967.394	4824.092	4479.495	1.076928	0.076928	7.692765
45	1762.686	1625.467	4013.402	3700.972	1.084418	0.084418	8.44182
46	1399.592	1280.069	3186.685	2914.547	1.093372	0.093372	9.337231
47	1028.174	930.574	2341.015	2118.793	1.104882	0.104882	10.48815
48	648.27	576.856	1476.025	1313.424	1.123799	0.123799	12.37987
49	247.935	213.43	564.515	485.9517	1.161669	0.161669	16.16689

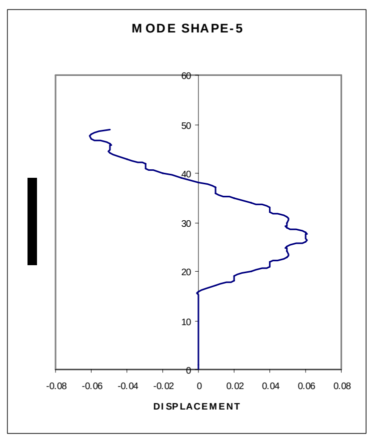
Different Mode Shape in Earthquake forces analysis

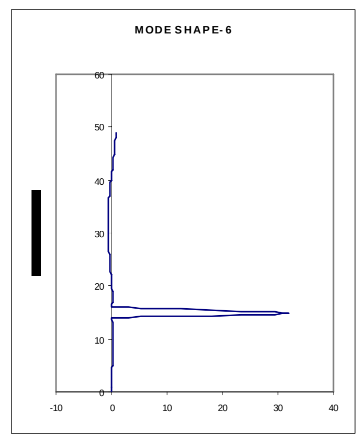


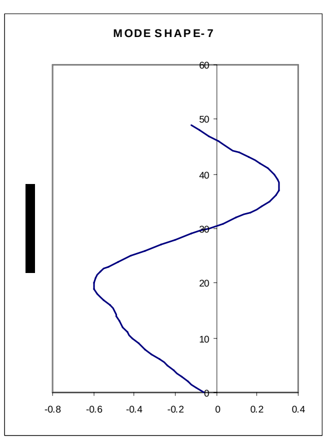


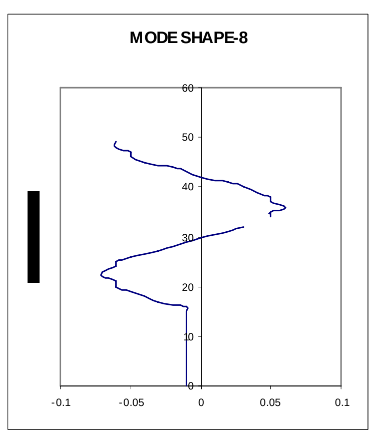


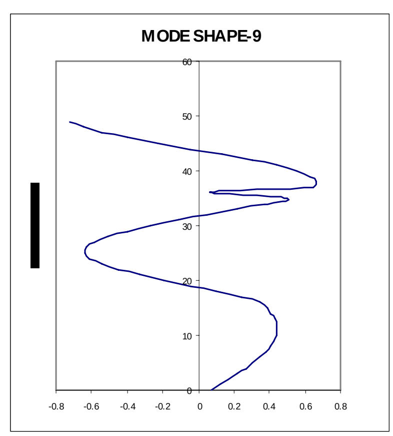


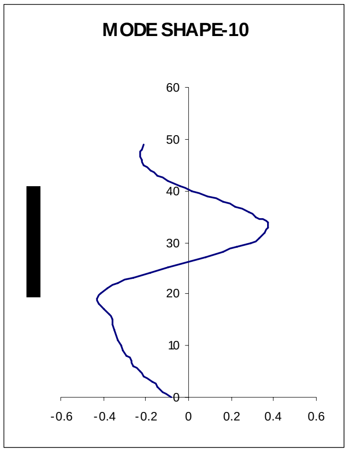








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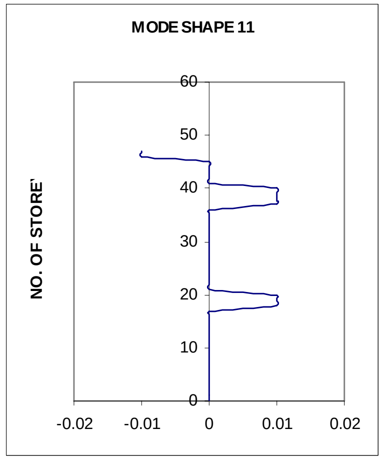
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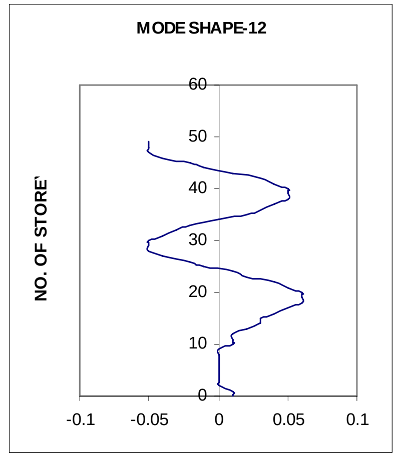
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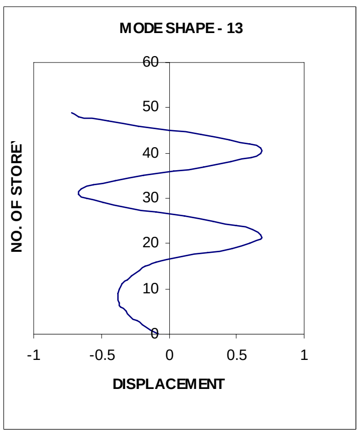
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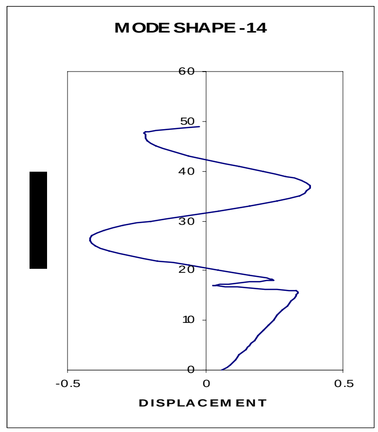
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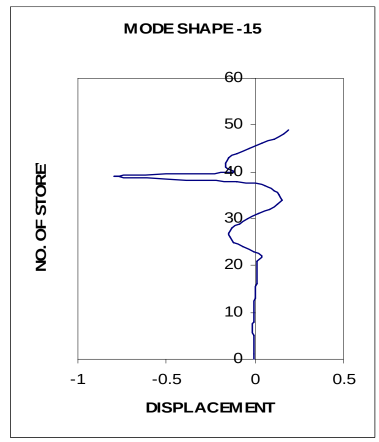
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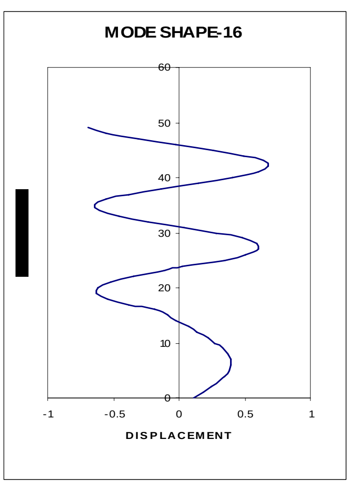
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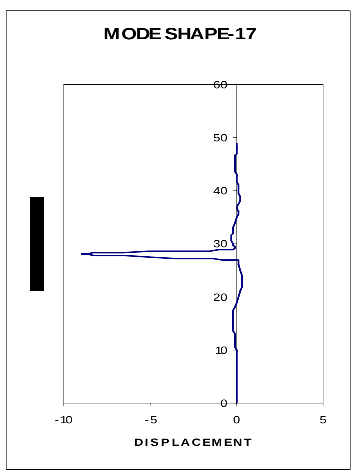
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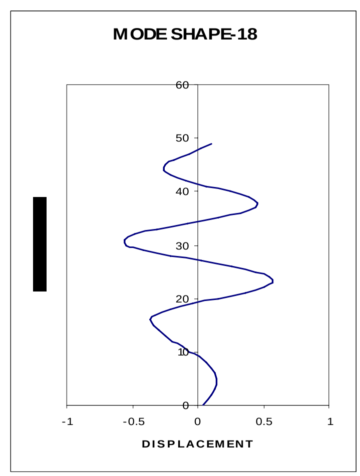
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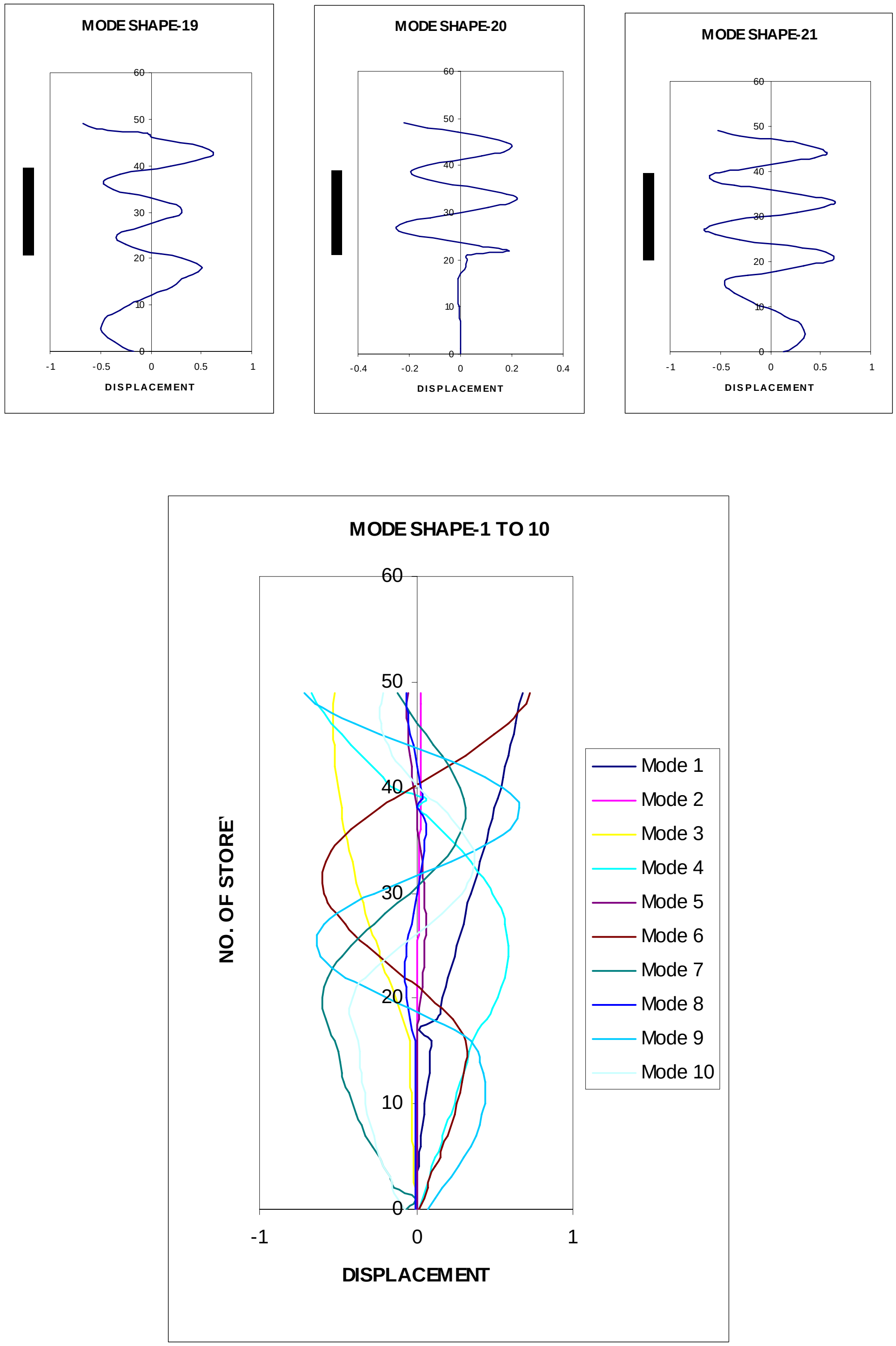


Fig 34: Different mode shapes of the building subjected to earthquake force

Table No. 10

Mode	Frequency Hz
1	0.132
2	0.194
3	0.307
4	0.526
5	0.719
6	0.923
7	0.956
8	1.207
9	1.336
10	1.518
11	1.664
12	1.676
13	1.782
14	2.015
15	2.207
16	2.246
17	2.551
18	2.615
19	2.699
20	2.904
21	3.014
22	3.338
23	3.391
24	3.468
25	3.599

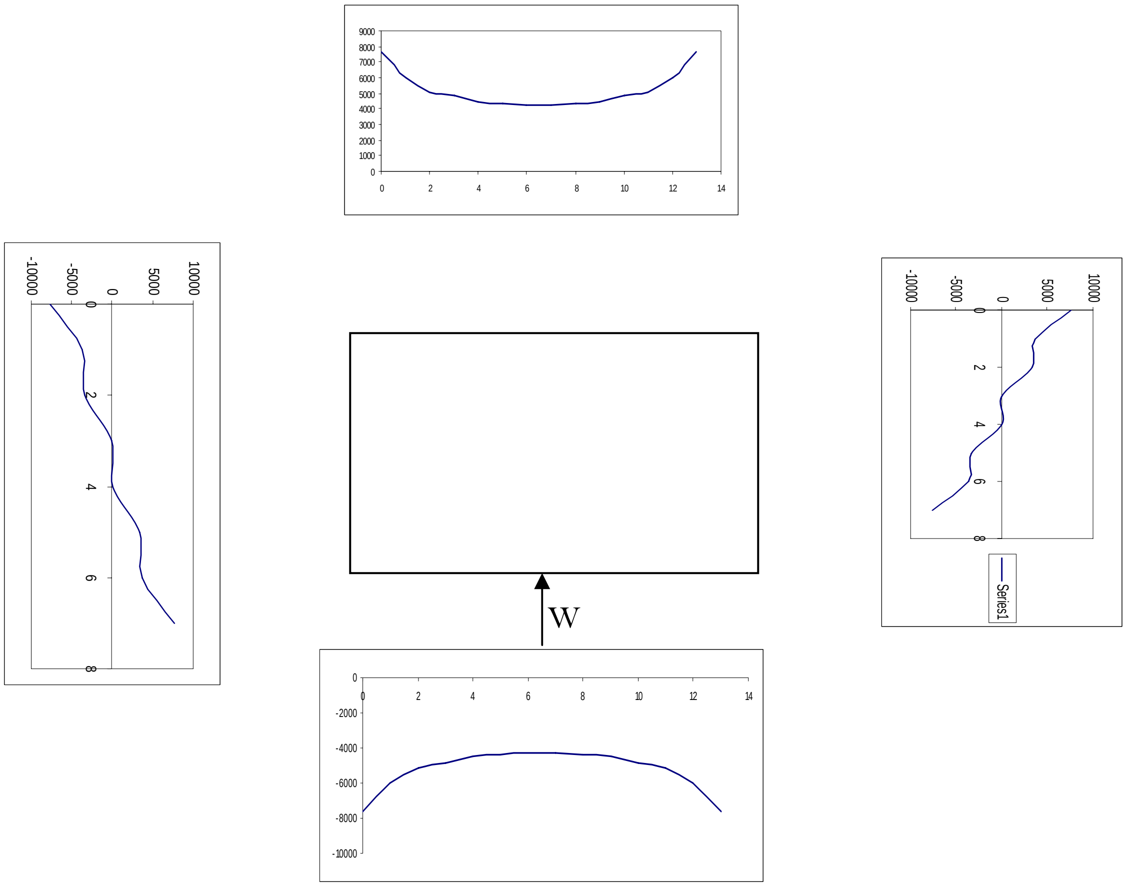


Fig No. 35– Stress distribution in open frame subjected to windload

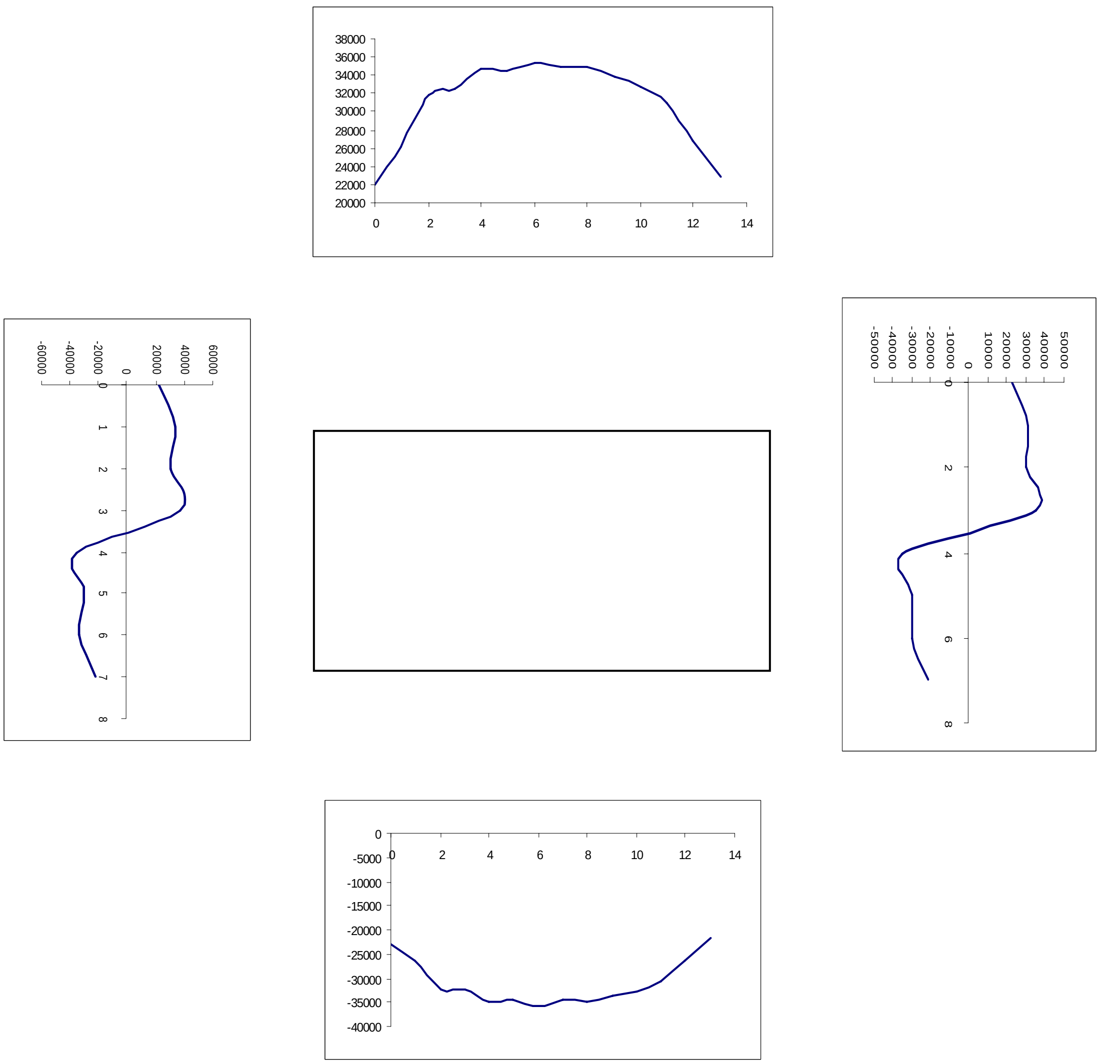


Fig 36: Axial stress distribution
(Building frame subjected with shear panel)

A. Comparison of maximum Deflection at top:

	Wind Effect	EQ Effect
(i) Frame Tube without shear panels	171 mm	102 mm
(ii) Frame tube with shear wall up to Full height.	123 mm	95mm
(iii) Frame tube with staggered shear panel up to rd height.	120 mm	92mm
(iv) Frame tube with K-pattern shear panel up to rd height	147 mm	NA
(v) Frame tube with x-pattern shear panel up to rd height	145 mm	97 mm

Note: For Earth Quake effect complete building outer tube and interior Bean Column has been taken

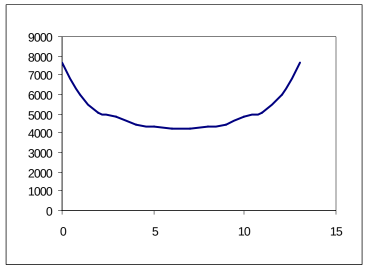
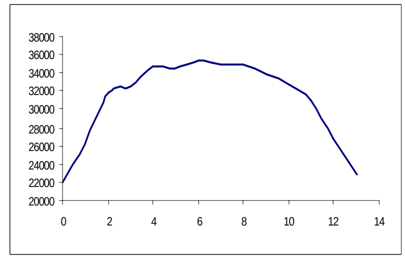
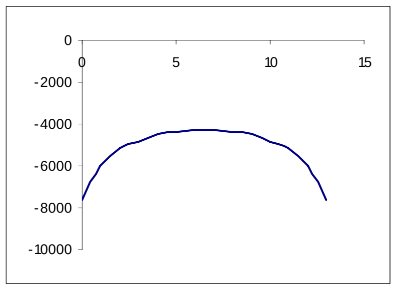
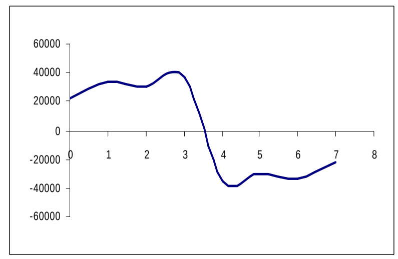
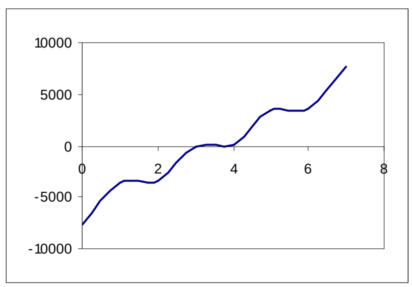
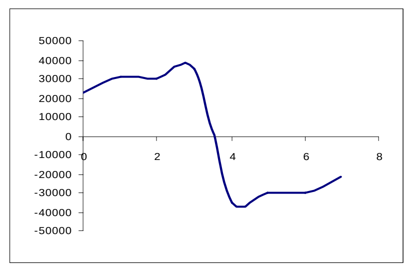
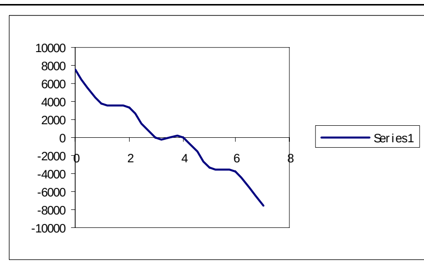
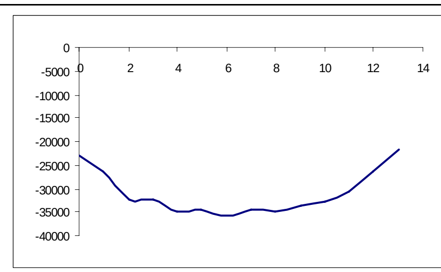
Remark: Staggerred shear panel up to rd height have been found more effective in caparison to shear wall of full height in controlling maximum deflection at top.

Deformation / storey drift of the building

In case of wind load essentially for static load building has been found as deforming in 1^{st} mode and has the combination of bending bean and shear beam behaviour.

In case of EQ effect story draft has been found following the pattern between 1^{st} mode and 2^{nd} mode.

Comparison of Axial stresses at base in all the columns in all the frames (For building with staggered shear panel)

Frame No.	Wind effect	EQ effect
Frame 1		
Frame 2		
Frame 3		
Frame 4		

References

1. J.J. Connor and C.C Pouangare Journal of Structural Engineering, Vol.117, No.12,Dec 1991 ASCE .PP 3623- 3644

2. Kenneth W. Shushkewich Journal of Structural Engineering Vol.117, No.17,Nov 1991,ASCE , PP 3543-3544

3. A.Coull, N.Subedi Journal of Structural Division , Precedings of ASCE , Vol 97,No. 8, Aug 1971,PP 2097-2105 Framed Tube Structure for High Rise Buildings

4. Taranath B.S. Structural Analysis and design of Tall Buildings

5. Fintel, M. Handbook of Concrete Design

6. Y. Singh Journal of Structural Engineering Vol.127, No.12,Nov 1993,ASCE PP 3543- 3546

7. S.C. Lee, C.H. Yoo Journal of Structural Engineering Vol. 128 , No. -11, Nov. 2002,

8. Kang-kun Lee, Yew-Chaye Loo Journal of Structural Engineering Vol. 127, No. 24, April 2001.

9. Peter C. Chang Journal of structural Engineering, Vol. 111, No.6, June 1985., ASCE, pp. 1326-1337.

10. Iain A. MacLeod
Journal of the Structural Division, Proceedings of ASCE, Vol. 95, No. ST3, March 1969, pp. 399-409.

11. William Weaver, Jr. M. F. Nelson
Journal of Structural Division, Proceedings of ASCE, Vol. 892, No. ST6, Dec. 1996, pp. 385-404.

12. B. Stafford Smith, Kuster, Hoendir-Kamp
Journal of Structural Engineering, Vol. 110, No. 7, July 1984, pp. 1549-1562.

13. A.Coull, and B. Bose
Journal of Structural Division, Proceedings of ASCE, vol. 101, NO. ST 11, Nov. 1975, pp. 2223-2240.

14. William Weaver, Jr. James, M.Gere
Matrix Analysis of Framed Structures.

15. F.W. Beufait
Computer Methods of Structural Analysis .

APPENDIX I

```
STAAD SPACE
START JOB INFORMATION
ENGINEER DATE 19-Feb-06
END JOB INFORMATION
INPUT WIDTH 79
UNIT METER KN
JOINT COORDINATES
1 0 0 0; 2 2.84 0 0; 3 5.68 0 0; 4 8.52 0 0; 5 11.36 0 0; 6 14.2 0 0;
7 17.04 0 0; 8 19.88 0 0; 9 22.72 0 0; 10 25.56 0 0; 11 28.4 0 0; 12 31.24 0 0;
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285 11.36 24.132 0; 286 14.2 24.132 0; 287 17.04 24.132 0; 288 19.88 24.132 0;
……………………….continue as per above for whole building…………………..

MEMBER INCIDENCES
1 1 41; 2 2 42; 3 3 43; 4 4 44; 5 5 45; 6 6 46; 7 7 47; 8 8 48; 9 9 49;
10 10 50; 11 11 51; 12 12 52; 13 13 53; 14 14 54; 15 15 55; 16 16 56; 17 17 57;

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ELEMENT INCIDENCES SHELL

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16057 608 609 569 568; 16058 610 611 571 570; 16059 612 613 573 572;
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16063 647 648 608 607; 16064 649 650 610 609; 16065 651 652 612 611;
16066 653 654 614 613; 16067 682 683 643 642; 16068 684 685 645 644;
16069 686 687 647 646; 16070 688 689 649 648; 16071 690 691 651 650;
…………………… continue as per above for whole building………………

ELEMENT PROPERTY
15863 TO 16182 THICKNESS 0.3
************************************************************************
*ELEMENT PROPERTY
*15863 TO 15921 THICKNESS 0.3
DEFINE MATERIAL START
ISOTROPIC MATERIAL1
E 2.5e+007
POISSON 0.17
DENSITY 24
DAMP 7.90066e+033
ISOTROPIC CONCRETE
E 2.17185e+007
POISSON 0.17
DENSITY 23.5616
ALPHA 1e-005
DAMP 0.05
END DEFINE MATERIAL
*ISOTROPIC CONCRETE
*E 2.17185e+007
*POISSON 0.17
*DENSITY 23.5616
*ALPHA 5.5e-006
*DAMP 0.05
*END DEFINE MATERIAL
*CONSTANTS
*MATERIAL MATERIAL1 MEMB 1 TO 4000
CONSTANTS
MATERIAL MATERIAL1 MEMB 1 TO 4000
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MATERIAL CONCRETE MEMB 4163 TO 7566 7568 TO 7575 7589 TO 9616 9779 TO
11254 -
11417 TO 13126 13289 TO 16682
MEMBER PROPERTY INDIAN
41 TO 80 PRIS YD 0.76 ZD 0.61
121 TO 160 201 TO 240 281 TO 320 361 TO 400 441 TO 480 521 TO 560 601 TO
640 -
681 TO 720 761 TO 800 841 TO 880 921 TO 960 1001 TO 1040 1081 TO 1120
1161 -
1162 TO 1200 1241 TO 1280 1321 TO 1360 1401 TO 1440 1481 TO 1520 1561 TO
1600 -
1641 TO 1680 1721 TO 1760 1801 TO 1840 1881 TO 1920 1961 TO 2000 -
2041 TO 2080 2121 TO 2160 2201 TO 2240 2281 TO 2320 2361 TO 2400 -
2441 TO 2480 2521 TO 2560 2601 TO 2640 2681 TO 2720 2761 TO 2800 -
2841 TO 2880 2921 TO 2960 3001 TO 3040 3081 TO 3120 3161 TO 3200 -
3241 TO 3280 3321 TO 3360 3401 TO 3440 3481 TO 3520 3561 TO 3600 -
3641 TO 3680 3721 TO 3760 3801 TO 3840 3881 TO 3920 3961 TO 3999 -
4000 PRIS YD 0.99 ZD 0.38
MEMBER PROPERTY INDIAN
1 TO 14 27 TO 40 81 TO 94 107 TO 120 161 TO 174 187 TO 200 PRIS YD 1.22 ZD
0.61
15 TO 26 95 TO 106 175 TO 186 PRIS YD 0.61 ZD 1.22
241 TO 254 267 TO 280 321 TO 334 347 TO 360 401 TO 414 427 TO 440 481 TO
494 -
507 TO 520 561 TO 574 587 TO 600 641 TO 654 667 TO 680 721 TO 734 -
747 TO 760 801 TO 814 827 TO 840 881 TO 894 907 TO 920 961 TO 974 -
987 TO 1000 1041 TO 1054 1067 TO 1080 1121 TO 1134 1147 TO 1160 1201 TO
1214 -
1227 TO 1240 1281 TO 1294 1307 TO 1320 1361 TO 1374 1387 TO 1400 -
1441 TO 1454 1467 TO 1480 1521 TO 1534 1547 TO 1560 PRIS YD 1.22 ZD 0.46
255 TO 266 335 TO 346 415 TO 426 495 TO 506 575 TO 586 655 TO 666 735 TO
746 -
815 TO 826 895 TO 906 975 TO 986 1055 TO 1066 1135 TO 1146 1215 TO 1226
1295 -
1296 TO 1306 1375 TO 1386 1455 TO 1466 1535 TO 1546 PRIS YD 0.46 ZD 1.22
1601 TO 1614 1627 TO 1640 1681 TO 1694 1707 TO 1720 1761 TO 1774 1787 TO
1800 -
1841 TO 1854 1867 TO 1880 1921 TO 1934 1947 TO 1960 2001 TO 2014 -
2027 TO 2040 2081 TO 2094 2107 TO 2120 2161 TO 2174 2187 TO 2200 -
2241 TO 2254 2267 TO 2280 2321 TO 2334 2347 TO 2360 2401 TO 2414 -
2427 TO 2440 2481 TO 2494 2507 TO 2520 PRIS YD 1.22 ZD 0.41
1615 TO 1626 1695 TO 1706 1775 TO 1786 1855 TO 1866 1935 TO 1946 2015 TO
2026 -
2095 TO 2106 2175 TO 2186 2255 TO 2266 2335 TO 2346 2415 TO 2426 -
2495 TO 2506 PRIS YD 0.41 ZD 1.22
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2561 TO 2574 2587 TO 2600 2641 TO 2654 2667 TO 2680 2721 TO 2734 2747 TO 2760 -
2801 TO 2814 2827 TO 2840 2881 TO 2894 2907 TO 2920 2961 TO 2974 -
2987 TO 3000 3041 TO 3054 3067 TO 3080 3121 TO 3134 3147 TO 3160 -
3201 TO 3214 3227 TO 3240 3281 TO 3294 3307 TO 3320 3361 TO 3374 -
3387 TO 3400 3441 TO 3454 3467 TO 3480 3521 TO 3534 3547 TO 3560 -
3601 TO 3614 3627 TO 3640 3681 TO 3694 3707 TO 3720 3761 TO 3774 -
3787 TO 3800 3841 TO 3854 3867 TO 3880 3921 TO 3934 3947 TO 3959 -
3960 PRIS YD 1.22 ZD 0.36
2575 TO 2586 2655 TO 2666 2735 TO 2746 2815 TO 2826 2895 TO 2906 2975 TO 2986 -
3055 TO 3066 3135 TO 3146 3215 TO 3226 3295 TO 3306 3375 TO 3386 -
3455 TO 3466 3535 TO 3546 3615 TO 3626 3695 TO 3706 3775 TO 3786 -
3855 TO 3866 3935 TO 3946 PRIS YD 0.36 ZD 1.22
MEMBER PROPERTY INDIAN
4163 TO 7566 7568 TO 7575 7589 TO 9616 9779 TO 11254 11417 TO 13126 13289 -
13290 TO 15862 16183 TO 16682 PRIS YD 0.6 ZD 0.6
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SUPPORTS
1 TO 40 2041 TO 2112 FIXED
*SUPPORTS
*1 TO 5712 PINNED
SLAVE ZX MASTER 2153 JOINT 41 TO 80 2113 TO 2152 2154 TO 2184
SLAVE ZX MASTER 2225 JOINT 81 TO 120 2185 TO 2224 2226 TO 2256
SLAVE ZX MASTER 2297 JOINT 121 TO 160 2257 TO 2296 2298 TO 2328
SLAVE ZX MASTER 2369 JOINT 161 TO 200 2329 TO 2368 2370 TO 2400
SLAVE ZX MASTER 2441 JOINT 201 TO 240 2401 TO 2440 2442 TO 2472
SLAVE ZX MASTER 2513 JOINT 241 TO 280 2473 TO 2512 2514 TO 2544
SLAVE ZX MASTER 2585 JOINT 281 TO 320 2545 TO 2584 2586 TO 2616
SLAVE ZX MASTER 2657 JOINT 321 TO 360 2617 TO 2656 2658 TO 2688
SLAVE ZX MASTER 2729 JOINT 361 TO 400 2689 TO 2728 2730 TO 2760
SLAVE ZX MASTER 2801 JOINT 401 TO 440 2761 TO 2800 2802 TO 2832
SLAVE ZX MASTER 2873 JOINT 441 TO 480 2833 TO 2872 2874 TO 2904
SLAVE ZX MASTER 2945 JOINT 481 TO 520 2905 TO 2944 2946 TO 2976
SLAVE ZX MASTER 3017 JOINT 521 TO 560 2977 TO 3016 3018 TO 3048
SLAVE ZX MASTER 3089 JOINT 561 TO 600 3049 TO 3088 3090 TO 3120
SLAVE ZX MASTER 3161 JOINT 601 TO 640 3121 TO 3160 3162 TO 3192
SLAVE ZX MASTER 3233 JOINT 641 TO 680 3193 TO 3232 3234 TO 3264
SLAVE ZX MASTER 3305 JOINT 681 TO 720 3265 TO 3304 3306 TO 3336
SLAVE ZX MASTER 3377 JOINT 721 TO 760 3337 TO 3376 3378 TO 3408
SLAVE ZX MASTER 3449 JOINT 761 TO 800 3409 TO 3448 3450 TO 3480
SLAVE ZX MASTER 3521 JOINT 801 TO 840 3481 TO 3520 3522 TO 3552
SLAVE ZX MASTER 3593 JOINT 841 TO 880 3553 TO 3592 3594 TO 3624
SLAVE ZX MASTER 3665 JOINT 881 TO 920 3625 TO 3664 3666 TO 3696
SLAVE ZX MASTER 3737 JOINT 921 TO 960 3697 TO 3736 3738 TO 3768

SLAVE ZX MASTER 3809 JOINT 961 TO 1000 3769 TO 3808 3810 TO 3840
SLAVE ZX MASTER 3881 JOINT 1001 TO 1040 3841 TO 3880 3882 TO 3912
SLAVE ZX MASTER 3953 JOINT 1041 TO 1080 3913 TO 3952 3954 TO 3984
SLAVE ZX MASTER 4025 JOINT 1081 TO 1120 3985 TO 4024 4026 TO 4056
SLAVE ZX MASTER 4097 JOINT 1121 TO 1160 4057 TO 4096 4098 TO 4128
SLAVE ZX MASTER 4169 JOINT 1161 TO 1200 4129 TO 4168 4170 TO 4200
SLAVE ZX MASTER 4241 JOINT 1201 TO 1240 4201 TO 4240 4242 TO 4272
SLAVE ZX MASTER 4313 JOINT 1241 TO 1280 4273 TO 4312 4314 TO 4344
SLAVE ZX MASTER 4385 JOINT 1281 TO 1320 4345 TO 4384 4386 TO 4416
SLAVE ZX MASTER 4457 JOINT 1321 TO 1360 4417 TO 4456 4458 TO 4488
SLAVE ZX MASTER 4529 JOINT 1361 TO 1400 4489 TO 4528 4530 TO 4560
SLAVE ZX MASTER 4601 JOINT 1401 TO 1440 4561 TO 4600 4602 TO 4632
SLAVE ZX MASTER 4673 JOINT 1441 TO 1480 4633 TO 4672 4674 TO 4704
SLAVE ZX MASTER 4745 JOINT 1481 TO 1520 4705 TO 4744 4746 TO 4776
SLAVE ZX MASTER 4817 JOINT 1521 TO 1560 4777 TO 4816 4818 TO 4848
SLAVE ZX MASTER 4889 JOINT 1561 TO 1600 4849 TO 4888 4890 TO 4920
SLAVE ZX MASTER 4961 JOINT 1601 TO 1640 4921 TO 4960 4962 TO 4992
SLAVE ZX MASTER 5033 JOINT 1641 TO 1680 4993 TO 5032 5034 TO 5064
SLAVE ZX MASTER 5105 JOINT 1681 TO 1720 5065 TO 5104 5106 TO 5136
SLAVE ZX MASTER 5177 JOINT 1721 TO 1760 5137 TO 5176 5178 TO 5208
SLAVE ZX MASTER 5249 JOINT 1761 TO 1800 5209 TO 5248 5250 TO 5280
SLAVE ZX MASTER 5321 JOINT 1801 TO 1840 5281 TO 5320 5322 TO 5352
SLAVE ZX MASTER 5393 JOINT 1841 TO 1880 5353 TO 5392 5394 TO 5424
SLAVE ZX MASTER 5465 JOINT 1881 TO 1920 5425 TO 5464 5466 TO 5496
SLAVE ZX MASTER 5537 JOINT 1921 TO 1960 5497 TO 5536 5538 TO 5568
SLAVE ZX MASTER 5609 JOINT 1961 TO 2000 5569 TO 5608 5610 TO 5640
SLAVE ZX MASTER 5681 JOINT 2001 TO 2040 5641 TO 5680 5682 TO 5712
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CUT OFF MODE SHAPE 25
LOAD 1 SPECTRM IN X DIRECTION
SELFWEIGHT X 1
SELFWEIGHT Y 1
SELFWEIGHT Z 1
****
JOINT LOAD
1 FX 26.792 FY 26.792 FZ 26.792
2 FX 26.792 FY 26.792 FZ 26.792
3 FX 26.792 FY 26.792 FZ 26.792
4 FX 26.792 FY 26.792 FZ 26.792
5 FX 26.792 FY 26.792 FZ 26.792
6 FX 26.792 FY 26.792 FZ 26.792
7 FX 26.792 FY 26.792 FZ 26.792
8 FX 26.792 FY 26.792 FZ 26.792
9 FX 26.792 FY 26.792 FZ 26.792
10 FX 26.792 FY 26.792 FZ 26.792

11 FX 26.792 FY 26.792 FZ 26.792
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29 FX 26.792 FY 26.792 FZ 26.792
30 FX 26.792 FY 26.792 FZ 26.792
31 FX 26.792 FY 26.792 FZ 26.792
32 FX 26.792 FY 26.792 FZ 26.792
33 FX 26.792 FY 26.792 FZ 26.792
34 FX 26.792 FY 26.792 FZ 26.792
35 FX 26.792 FY 26.792 FZ 26.792
36 FX 26.792 FY 26.792 FZ 26.792
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38 FX 26.792 FY 26.792 FZ 26.792
39 FX 26.792 FY 26.792 FZ 26.792
40 FX 26.792 FY 26.792 FZ 26.792
41 FX 154.185 FY 154.185 FZ 154.185
42 FX 167.378 FY 167.378 FZ 167.378
43 FX 166.627 FY 166.627 FZ 166.627
44 FX 166.576 FY 166.576 FZ 166.576
45 FX 166.577 FY 166.577 FZ 166.577
46 FX 166.577 FY 166.577 FZ 166.577
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51 FX 166.577 FY 166.577 FZ 166.577
52 FX 166.628 FY 166.628 FZ 166.628
53 FX 167.394 FY 167.394 FZ 167.394
54 FX 154.296 FY 154.296 FZ 154.296
55 FX 168.312 FY 168.312 FZ 168.312
56 FX 168.344 FY 168.344 FZ 168.344

57 FX 166.687 FY 166.687 FZ 166.687
58 FX 166.707 FY 166.707 FZ 166.707
59 FX 166.575 FY 166.575 FZ 166.575
60 FX 166.595 FY 166.595 FZ 166.595
61 FX 166.575 FY 166.575 FZ 166.575
62 FX 166.595 FY 166.595 FZ 166.595
63 FX 166.687 FY 166.687 FZ 166.687
64 FX 166.707 FY 166.707 FZ 166.707
65 FX 168.312 FY 168.312 FZ 168.312
66 FX 168.344 FY 168.344 FZ 168.344
67 FX 154.185 FY 154.185 FZ 154.185
68 FX 167.378 FY 167.378 FZ 167.378
69 FX 166.627 FY 166.627 FZ 166.627
70 FX 166.576 FY 166.576 FZ 166.576
71 FX 166.577 FY 166.577 FZ 166.577
72 FX 166.577 FY 166.577 FZ 166.577
73 FX 166.577 FY 166.577 FZ 166.577
74 FX 166.577 FY 166.577 FZ 166.577
75 FX 166.577 FY 166.577 FZ 166.577
76 FX 166.577 FY 166.577 FZ 166.577
77 FX 166.577 FY 166.577 FZ 166.577
78 FX 166.628 FY 166.628 FZ 166.628
79 FX 167.394 FY 167.394 FZ 167.394
80 FX 154.296 FY 154.296 FZ 154.296
81 FX 163.483 FY 163.483 FZ 163.483
82 FX 204.387 FY 204.387 FZ 204.387
83 FX 203.497 FY 203.497 FZ 203.497
84 FX 203.465 FY 203.465 FZ 203.465
85 FX 203.465 FY 203.465 FZ 203.465
86 FX 203.465 FY 203.465 FZ 203.465
87 FX 203.465 FY 203.465 FZ 203.465
88 FX 203.465 FY 203.465 FZ 203.465
89 FX 203.465 FY 203.465 FZ 203.465
90 FX 203.465 FY 203.465 FZ 203.465
91 FX 203.465 FY 203.465 FZ 203.465
92 FX 203.55 FY 203.55 FZ 203.55
93 FX 204.637 FY 204.637 FZ 204.637
94 FX 163.304 FY 163.304 FZ 163.304
95 FX 205.463 FY 205.463 FZ 205.463
96 FX 205.405 FY 205.405 FZ 205.405
97 FX 203.538 FY 203.538 FZ 203.538
98 FX 203.491 FY 203.491 FZ 203.491
99 FX 203.466 FY 203.466 FZ 203.466
100 FX 203.426 FY 203.426 FZ 203.426
101 FX 203.466 FY 203.466 FZ 203.466
102 FX 203.426 FY 203.426 FZ 203.426

103 FX 203.538 FY 203.538 FZ 203.538
104 FX 203.491 FY 203.491 FZ 203.491
105 FX 205.463 FY 205.463 FZ 205.463
106 FX 205.405 FY 205.405 FZ 205.405
107 FX 163.483 FY 163.483 FZ 163.483
108 FX 204.387 FY 204.387 FZ 204.387
109 FX 203.497 FY 203.497 FZ 203.497
110 FX 203.465 FY 203.465 FZ 203.465
111 FX 203.465 FY 203.465 FZ 203.465
112 FX 203.465 FY 203.465 FZ 203.465
113 FX 203.465 FY 203.465 FZ 203.465
114 FX 203.464 FY 203.464 FZ 203.464
115 FX 203.465 FY 203.465 FZ 203.465
116 FX 203.465 FY 203.465 FZ 203.465
117 FX 203.465 FY 203.465 FZ 203.465
118 FX 203.55 FY 203.55 FZ 203.55
119 FX 204.637 FY 204.637 FZ 204.637
120 FX 163.304 FY 163.304 FZ 163.304
121 FX 155.545 FY 155.545 FZ 155.545
122 FX 196.46 FY 196.46 FZ 196.46
123 FX 195.467 FY 195.467 FZ 195.467
124 FX 195.429 FY 195.429 FZ 195.429
125 FX 195.427 FY 195.427 FZ 195.427
126 FX 195.427 FY 195.427 FZ 195.427
127 FX 195.427 FY 195.427 FZ 195.427
128 FX 195.427 FY 195.427 FZ 195.427
129 FX 195.427 FY 195.427 FZ 195.427
130 FX 195.427 FY 195.427 FZ 195.427
131 FX 195.435 FY 195.435 FZ 195.435
132 FX 195.578 FY 195.578 FZ 195.578
133 FX 185.879 FY 185.879 FZ 185.879
134 FX 145.719 FY 145.719 FZ 145.719
135 FX 197.861 FY 197.861 FZ 197.861
136 FX 176.595 FY 176.595 FZ 176.595
137 FX 195.524 FY 195.524 FZ 195.524
138 FX 174.654 FY 174.654 FZ 174.654
139 FX 195.432 FY 195.432 FZ 195.432
140 FX 174.572 FY 174.572 FZ 174.572
141 FX 195.432 FY 195.432 FZ 195.432
142 FX 174.572 FY 174.572 FZ 174.572
143 FX 195.524 FY 195.524 FZ 195.524
144 FX 174.654 FY 174.654 FZ 174.654
145 FX 197.861 FY 197.861 FZ 197.861
146 FX 176.595 FY 176.595 FZ 176.595
147 FX 155.545 FY 155.545 FZ 155.545
148 FX 196.46 FY 196.46 FZ 196.46

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149 FX 195.467 FY 195.467 FZ 195.467
150 FX 195.429 FY 195.429 FZ 195.429
151 FX 195.427 FY 195.427 FZ 195.427
152 FX 195.427 FY 195.427 FZ 195.427
153 FX 195.426 FY 195.426 FZ 195.426
154 FX 195.426 FY 195.426 FZ 195.426
155 FX 195.427 FY 195.427 FZ 195.427
156 FX 195.427 FY 195.427 FZ 195.427
157 FX 195.435 FY 195.435 FZ 195.435
158 FX 195.578 FY 195.578 FZ 195.578
159 FX 185.879 FY 185.879 FZ 185.879
160 FX 145.719 FY 145.719 FZ 145.719
161 FX 145.987 FY 145.987 FZ 145.987
162 FX 188.237 FY 188.237 FZ 188.237
163 FX 187.174 FY 187.174 FZ 187.174
164 FX 187.126 FY 187.126 FZ 187.126
165 FX 187.123 FY 187.123 FZ 187.123
166 FX 187.123 FY 187.123 FZ 187.123
167 FX 187.123 FY 187.123 FZ 187.123
168 FX 187.123 FY 187.123 FZ 187.123
169 FX 187.123 FY 187.123 FZ 187.123
170 FX 187.124 FY 187.124 FZ 187.
..................... continue as per above for whole building..................
**************************************************************************
SPECTRUM CQC X 0.09 ACC SCALE 9.81 DAMP 0.05
0 2.5; 0.1 2.5; 0.2 2.5; 0.3 2.5; 0.4 2.5; 0.5 2.5; 0.6 2.38; 0.7 1.92;
0.8 1.75; 0.9 1.47; 1 1.34; 1.1 1.3; 1.2 1.18; 1.3 1.09; 1.4 0.96; 1.5 0.92;
1.6 0.87; 1.7 0.84; 1.8 0.8; 1.9 0.75; 2 0.71; 2.1 0.67; 2.2 0.62; 2.3 0.604;
2.4 0.563; 2.5 0.555; 2.6 0.54; 2.7 0.501; 2.8 0.5; 2.9 0.479; 3.1 0.437;
3.2 0.43; 3.3 0.42; 3.4 0.416; 3.5 0.415; 3.6 0.395; 3.7 0.38; 3.8 0.34;
3.9 0.33; 4 0.291;
LOAD 2 SPECTRUM IN Z DIRECTION
SPECTRUM CQC Z 0.122 ACC SCALE 9.81 DAMP 0.05
0 2.5; 0.1 2.5; 0.2 2.5; 0.3 2.5; 0.4 2.5; 0.5 2.5; 0.6 2.38; 0.7 1.92;
0.8 1.75; 0.9 1.47; 1 1.34; 1.1 1.3; 1.2 1.18; 1.3 1.09; 1.4 0.96; 1.5 0.92;
1.6 0.87; 1.7 0.84; 1.8 0.8; 1.9 0.75; 2 0.71; 2.1 0.67; 2.2 0.62; 2.3 0.604;
2.4 0.563; 2.5 0.555; 2.6 0.54; 2.7 0.501; 2.8 0.5; 2.9 0.479; 3.1 0.437;
3.2 0.43; 3.3 0.42; 3.4 0.416; 3.5 0.415; 3.6 0.395; 3.7 0.38; 3.8 0.34;
3.9 0.33; 4 0.291;
LOAD 3 DEAD LOAD-SLAB
SELFWEIGHT Y -1
FLOOR LOAD
YRANGE 6.322 6.522 FLOAD -3.125 XRANGE 0 36.92 ZRANGE 0 19.88
YRANGE 9.844 10.044 FLOAD -3.125 XRANGE 0 36.22 ZRANGE 0 19.88
YRANGE 13.366 13.566 FLOAD -3.125 XRANGE 0 36.22 ZRANGE 0 19.88
YRANGE 16.844 17.088 FLOAD -3.125 XRANGE 0 36.22 ZRANGE 0 19.88
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YRANGE 20.41 20.61 FLOAD -3.125 XRANGE 0 36.22 ZRANGE 0 19.88
YRANGE 23.932 34.132 FLOAD -3.125 XRANGE 0 36.22 ZRANGE 0 19.88
YRANGE 27.454 27.654 FLOAD -3.125 XRANGE 0 36.22 ZRANGE 0 19.88
YRANGE 30.976 31.176 FLOAD -3.125 XRANGE 0 36.22 ZRANGE 0 19.88
YRANGE 34.498 34.698 FLOAD -3.125 XRANGE 0 36.22 ZRANGE 0 19.88
YRANGE 38.02 38.22 FLOAD -3.125 XRANGE 0 36.22 ZRANGE 0 19.88
YRANGE 41.542 41.742 FLOAD -3.125 XRANGE 0 36.22 ZRANGE 0 19.88
YRANGE 45.064 45.264 FLOAD -3.125 XRANGE 0 36.22 ZRANGE 0 19.88
YRANGE 48.586 48.786 FLOAD -3.125 XRANGE 0 36.22 ZRANGE 0 19.88
YRANGE 52.108 52.308 FLOAD -3.125 XRANGE 0 36.22 ZRANGE 0 19.88
YRANGE 55.63 55.83 FLOAD -3.125 XRANGE 0 36.22 ZRANGE 0 19.88
YRANGE 59.152 59.352 FLOAD -3.125 XRANGE 0 36.22 ZRANGE 0 19.88
YRANGE 62.674 62.874 FLOAD -3.125 XRANGE 0 36.22 ZRANGE 0 19.88
YRANGE 66.196 66.396 FLOAD -3.125 XRANGE 0 36.22 ZRANGE 0 19.88
YRANGE 69.718 69.918 FLOAD -3.125 XRANGE 0 36.22 ZRANGE 0 19.88
YRANGE 73.24 73.44 FLOAD -3.125 XRANGE 0 36.22 ZRANGE 0 19.88
YRANGE 76.762 76.962 FLOAD -3.125 XRANGE 0 36.22 ZRANGE 0 19.88
YRANGE 80.284 80.484 FLOAD -3.125 XRANGE 0 36.22 ZRANGE 0 19.88
YRANGE 83.9 84.1 FLOAD -3.125 XRANGE 0 37 ZRANGE 0 20
YRANGE 87.328 87.528 FLOAD -3.125 XRANGE 0 36.22 ZRANGE 0 19.88
YRANGE 90.85 91.05 FLOAD -3.125 XRANGE 0 36.22 ZRANGE 0 19.88
YRANGE 94.372 94.572 FLOAD -3.125 XRANGE 0 36.22 ZRANGE 0 19.88
YRANGE 97.894 98.094 FLOAD -3.125 XRANGE 0 36.22 ZRANGE 0 19.88
YRANGE 101.416 101.616 FLOAD -3.125 XRANGE 0 36.22 ZRANGE 0 19.88
YRANGE 104.938 105.138 FLOAD -3.125 XRANGE 0 36.22 ZRANGE 0 19.88
YRANGE 108.6 108.8 FLOAD -3.125 XRANGE 0 37 ZRANGE 0 20
YRANGE 111.982 112.182 FLOAD -3.125 XRANGE 0 36.22 ZRANGE 0 19.88
YRANGE 115.504 115.704 FLOAD -3.125 XRANGE 0 36.22 ZRANGE 0 19.88
YRANGE 119.026 119.226 FLOAD -3.125 XRANGE 0 36.22 ZRANGE 0 19.88
YRANGE 122.548 122.748 FLOAD -3.125 XRANGE 0 36.22 ZRANGE 0 19.88
YRANGE 126.07 126.27 FLOAD -3.125 XRANGE 0 36.22 ZRANGE 0 19.88
YRANGE 129.592 129.792 FLOAD -3.125 XRANGE 0 36.22 ZRANGE 0 19.88
YRANGE 133.114 133.314 FLOAD -3.125 XRANGE 0 36.22 ZRANGE 0 19.88
YRANGE 136.7 136.9 FLOAD -3.125 XRANGE 0 37 ZRANGE 0 20
YRANGE 140.158 140.358 FLOAD -3.125 XRANGE 0 36.22 ZRANGE 0 19.88
YRANGE 143.68 143.88 FLOAD -3.125 XRANGE 0 36.22 ZRANGE 0 19.88
YRANGE 147.202 147.402 FLOAD -3.125 XRANGE 0 36.22 ZRANGE 0 19.88
YRANGE 150.724 150.924 FLOAD -3.125 XRANGE 0 36.22 ZRANGE 0 19.88
YRANGE 154.246 154.446 FLOAD -3.125 XRANGE 0 36.22 ZRANGE 0 19.88
YRANGE 157.768 157.968 FLOAD -3.125 XRANGE 0 36.22 ZRANGE 0 19.88
YRANGE 161.29 161.49 FLOAD -3.125 XRANGE 0 36.22 ZRANGE 0 19.88
YRANGE 164.812 165.012 FLOAD -3.125 XRANGE 0 36.22 ZRANGE 0 19.88
YRANGE 168.334 168.534 FLOAD -3.125 XRANGE 0 36.22 ZRANGE 0 19.88
YRANGE 171.856 172.056 FLOAD -3.125 XRANGE 0 36.22 ZRANGE 0 19.88
YRANGE 175.378 175.578 FLOAD -3.125 XRANGE 0 36.22 ZRANGE 0 19.88
**LOAD 3 DEAD LOAD-BRICKWALL

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MEMBER LOAD
41 TO 80 121 TO 160 201 TO 240 281 TO 320 361 TO 400 441 TO 480 521 TO 560
-
601 TO 640 681 TO 720 761 TO 800 841 TO 880 921 TO 960 1001 TO 1040 1081 -
1082 TO 1120 1161 TO 1200 1241 TO 1280 1321 TO 1360 1401 TO 1440 1481 TO
1520 -
1561 TO 1600 1641 TO 1680 1721 TO 1760 1801 TO 1840 1881 TO 1920 -
1961 TO 2000 2041 TO 2080 2121 TO 2160 2201 TO 2240 2281 TO 3600 -
3641 TO 4000 4235 TO 4396 4469 TO 4630 4703 TO 4864 4937 TO 5098 -
5171 TO 5332 5405 TO 5566 5639 TO 5800 5873 TO 6034 6107 TO 6268 -
6341 TO 6502 6575 TO 6736 6809 TO 6970 7043 TO 7204 7277 TO 7438 -
7511 TO 7566 7568 TO 7575 7589 TO 7672 7745 TO 7906 7979 TO 8140 -
8213 TO 8374 8447 TO 8608 8681 TO 8842 8915 TO 9076 9149 TO 9310 -
9383 TO 9544 9851 TO 10012 10085 TO 10246 10319 TO 10480 10553 TO 10714 -
10787 TO 11254 11417 TO 13126 13289 TO 14692 14765 TO 15862 16197 TO
16681 -
16682 UNI GY -11.25
************************************************************************LOAD 4 LIVE LOAD-
SLAB
FLOOR LOAD
YRANGE 6.322 6.522 FLOAD -2 XRANGE 0 36.92 ZRANGE 0 19.88
YRANGE 9.844 10.044 FLOAD -2 XRANGE 0 36.22 ZRANGE 0 19.88
YRANGE 13.366 13.566 FLOAD -2 XRANGE 0 36.22 ZRANGE 0 19.88
YRANGE 16.844 17.088 FLOAD -2 XRANGE 0 36.22 ZRANGE 0 19.88
YRANGE 20.41 20.61 FLOAD -2 XRANGE 0 36.22 ZRANGE 0 19.88
YRANGE 23.932 34.132 FLOAD -2 XRANGE 0 36.22 ZRANGE 0 19.88
YRANGE 27.454 27.654 FLOAD -2 XRANGE 0 36.22 ZRANGE 0 19.88
YRANGE 30.976 31.176 FLOAD -2 XRANGE 0 36.22 ZRANGE 0 19.88
YRANGE 34.498 34.698 FLOAD -2 XRANGE 0 36.22 ZRANGE 0 19.88
YRANGE 38.02 38.22 FLOAD -2 XRANGE 0 36.22 ZRANGE 0 19.88
YRANGE 41.542 41.742 FLOAD -2 XRANGE 0 36.22 ZRANGE 0 19.88
YRANGE 45.064 45.264 FLOAD -2 XRANGE 0 36.22 ZRANGE 0 19.88
YRANGE 48.586 48.786 FLOAD -2 XRANGE 0 36.22 ZRANGE 0 19.88
YRANGE 52.108 52.308 FLOAD -2 XRANGE 0 36.22 ZRANGE 0 19.88
YRANGE 55.63 55.83 FLOAD -2 XRANGE 0 36.22 ZRANGE 0 19.88
YRANGE 59.152 59.352 FLOAD -2 XRANGE 0 36.22 ZRANGE 0 19.88
YRANGE 62.674 62.874 FLOAD -2 XRANGE 0 36.22 ZRANGE 0 19.88
YRANGE 66.196 66.396 FLOAD -2 XRANGE 0 36.22 ZRANGE 0 19.88
YRANGE 69.718 69.918 FLOAD -2 XRANGE 0 36.22 ZRANGE 0 19.88
YRANGE 73.24 73.44 FLOAD -2 XRANGE 0 36.22 ZRANGE 0 19.88
YRANGE 76.762 76.962 FLOAD -2 XRANGE 0 36.22 ZRANGE 0 19.88
YRANGE 80.284 80.484 FLOAD -2 XRANGE 0 36.22 ZRANGE 0 19.88
YRANGE 83.9 84.1 FLOAD -2 XRANGE 0 37 ZRANGE 0 20
YRANGE 87.328 87.528 FLOAD -2 XRANGE 0 36.22 ZRANGE 0 19.88
YRANGE 90.85 91.05 FLOAD -2 XRANGE 0 36.22 ZRANGE 0 19.88
YRANGE 94.372 94.572 FLOAD -2 XRANGE 0 36.22 ZRANGE 0 19.88
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YRANGE 97.894 98.094 FLOAD -2 XRANGE 0 36.22 ZRANGE 0 19.88
YRANGE 101.416 101.616 FLOAD -2 XRANGE 0 36.22 ZRANGE 0 19.88
YRANGE 104.938 105.138 FLOAD -2 XRANGE 0 36.22 ZRANGE 0 19.88
YRANGE 108.6 108.8 FLOAD -2 XRANGE 0 37 ZRANGE 0 20
YRANGE 111.982 112.182 FLOAD -2 XRANGE 0 36.22 ZRANGE 0 19.88
YRANGE 115.504 115.704 FLOAD -2 XRANGE 0 36.22 ZRANGE 0 19.88
YRANGE 119.026 119.226 FLOAD -2 XRANGE 0 36.22 ZRANGE 0 19.88
YRANGE 122.548 122.748 FLOAD -2 XRANGE 0 36.22 ZRANGE 0 19.88
YRANGE 126.07 126.27 FLOAD -2 XRANGE 0 36.22 ZRANGE 0 19.88
YRANGE 129.592 129.792 FLOAD -2 XRANGE 0 36.22 ZRANGE 0 19.88
YRANGE 133.114 133.314 FLOAD -2 XRANGE 0 36.22 ZRANGE 0 19.88
YRANGE 136.7 136.9 FLOAD -2 XRANGE 0 37 ZRANGE 0 20
YRANGE 140.158 140.358 FLOAD -2 XRANGE 0 36.22 ZRANGE 0 19.88
YRANGE 143.68 143.88 FLOAD -2.4 XRANGE 0 36.22 ZRANGE 0 19.88
YRANGE 147.202 147.402 FLOAD -2.4 XRANGE 0 36.22 ZRANGE 0 19.88
YRANGE 150.724 150.924 FLOAD -2.4 XRANGE 0 36.22 ZRANGE 0 19.88
YRANGE 154.246 154.446 FLOAD -2.4 XRANGE 0 36.22 ZRANGE 0 19.88
YRANGE 157.768 157.968 FLOAD -2.4 XRANGE 0 36.22 ZRANGE 0 19.88
YRANGE 161.29 161.49 FLOAD -2.8 XRANGE 0 36.22 ZRANGE 0 19.88
YRANGE 164.812 165.012 FLOAD -3.2 XRANGE 0 36.22 ZRANGE 0 19.88
YRANGE 168.334 168.534 FLOAD -3.6 XRANGE 0 36.22 ZRANGE 0 19.88
YRANGE 171.856 172.056 FLOAD -4 XRANGE 0 36.22 ZRANGE 0 19.88
YRANGE 175.378 175.578 FLOAD -4 XRANGE 0 36.22 ZRANGE 0 19.88
*********************************************************************
LOAD COMB 10 1.5(DL+LL)
3 1.5 4 1.5
LOAD COMB 11 1.5(DL+LOADX)
3 1.5 4 1.5 1 1.5
LOAD COMB 12 1.5(DL-LOADX)
3 1.5 4 1.5 1 -1.5
LOAD COMB 13 1.5(DL+LOADZ)
3 1.5 4 1.5 2 1.5
LOAD COMB 14 1.5(DL-LOADZ)
3 1.5 4 1.5 2 -1.5
LOAD COMB 15 1.2(DL+LL+LOADX)
3 1.2 4 1.2 1 1.2
LOAD COMB 16 1.2(DL+LL-LOADX)
3 1.2 4 1.2 1 -1.2
LOAD COMB 17 1.2(DL+LL+LOADZ)
3 1.2 4 1.2 2 1.2
LOAD COMB 18 1.2(DL+LL-LOADZ)
3 1.2 4 1.2 2 -1.2
****************************
PERFORM ANALYSIS PRINT STATICS CHECK

*LOAD COMB 5 WORKING
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*3 1.0 4 1.0
*LOAD COMB 6 FACTORED
*3 1.5 4 1.5
* PERFORM ANALYSIS PRINT STATICS CHECK
*
LOAD LIST 17 TO 18
*PRINT SUPPORT REACTION
*PRINT MEMBER STRESSES
*PRINT DEFLECTIONS
FINISH
```