"Seismic Behaviour of RC Multi-storey Building Frame Structure With different Plan Configuration"

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Abstract -Todays world facing some of the major problems causing by the nature. One of the major natural disasters is the Earthquake. We never know the Direction of the attack and magnitude of the Earthquake, so it will be the challenge the science and Technology. Past few years research done on the various issues of Earthquake. Now a Days people live in Multi-story Buildings such case when Earthquake knockout the populated areas it will be cause massive loss of Damage. Hence Earthquake analysis get importance to Analysis the structure safe against the collapse and Design the structure to safe against Earthquake occur during the life time of the structure. In this study model a G+16 Structure with different plan configuration like as L-Shape, T-shape and I-Shape and Rectangular Shape in Staad Pro and Analysis the Earthquake analysis of the Structure in Two Different seismic zones IV with Soft and Medium soil of India. In this work, In this study, the comparative analysis of RC multistory building framed structure in the term of Maximum Bending Moment, Maximum Shear Force, Maximum Axial Forces, Story wise Displacement, Base Reaction.

***Key Words*:**Seismic zone, Soil type, Multistory RC Building, Staad Pro Software etc.

1. INTRODUCTION

Tremor is a characteristic marvel, which is produced in earth's hull. Length of seismic tremor is normally rather short, enduring from few moments to over a moment or thereabouts. In any case, a great many individuals lose their carries on with because of tremors in various pieces of the world. Building breakdown or harms are the significant misfortune because of seismic tremor ground movement. Horizontal soundness has consistently been a significant issue of structures particularly in the zones with high seismic tremor risk this issue has been contemplated and concentric, unconventional and knee propping frameworks have been recommended and thusly utilized by structural architects. The propping framework that has a more plastic disfigurement before breakdown can retain more vitality during the seismic tremor. The main role of a wide range of basic frameworks utilized in the structure kind of structures is to move gravity stacks successfully. The most well-known burdens coming about because of the impact of gravity are dead burden, live burden and snow load. Other than these vertical burdens, structures are likewise exposed to horizontal burdens brought about by wind, impacting or quake. Parallel burdens can grow high anxieties, produce influence development or cause vibration. Thusly, it is significant for the structure to have adequate quality against vertical loads along with sufficient firmness to oppose parallel powers. Propping is a profoundly productive and conservative technique to along the side solidify the casing structures against tremor and wind loads. A propped bowed comprises of regular segments and braces whose main role is to help the gravity stacking, and corner to corner supporting individuals that are associated so all out arrangement of individuals frames a vertical cantilever bracket to oppose the even powers. Supporting is effective on the grounds that the diagonals work in hub stress and along these lines call for least part estimates in giving the solidness and quality against level shear.

For the most part, the utilization of bracings rather than Shear dividers gives lower solidness and protection from a structure yet it ought not be overlooked that such a framework has lower weight and more valuable for engineering purposes. Utilization of supports for seismic recovery of structures ought not cause any twist issue and architects ought to know about expanding the hub heaps of sections in propping boards. The best and handy strategy for upgrading the seismic obstruction is to build the vitality retention limit of structures by consolidating supporting components in the casing. The supported edge can ingest a more prominent level of vitality applied by tremors. In propped outline decreases the section and brace twisting minutes. Propping individuals are broadly utilized in steel structures to lessen horizontal removals and disperse vitality during solid ground movements. The supports are typically positioned in vertically adjusted ranges. This framework permits acquiring an incredible increment of solidness with an insignificant included weight, thus it is exceptionally successful for existing structure for which the helpless horizontal firmness is the primary issue. The concentric bracings increment the parallel solidness of the edge, in this manner expanding the regular recurrence and furthermore generally diminishing the horizontal float. Be that as it may, increment in the firmness may draw in a bigger idleness power because of tremor. Further, while the bracings decline the twisting minutes and shear powers in sections, they increment the hub pressure in the segments to which they are associated.

1.2 PROBLEM DEFINITION

A RCC Structure is for the most part a gathering of Beams, Columns, Slabs and establishment interconnected to one another as a solitary unit. By and large the exchange of burden in these structures is from section to bar, from bar to segment lastly segment to establishment which thus moves the whole burden to the dirt. In this examination, we have embraced three cases by expecting various shapes for the structure displayed utilizing STAAD-Pro. We have embraced three cases by expecting distinctive arrangement shapes, for example, I-Shape, L-Shape, T-Shape and Rectangular- Shape

Proposed Building Plan:

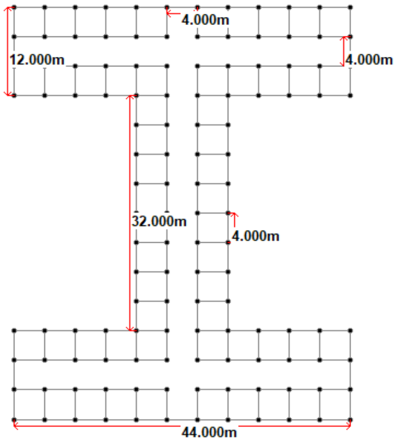


Fig.1.1 I-Shape Plan

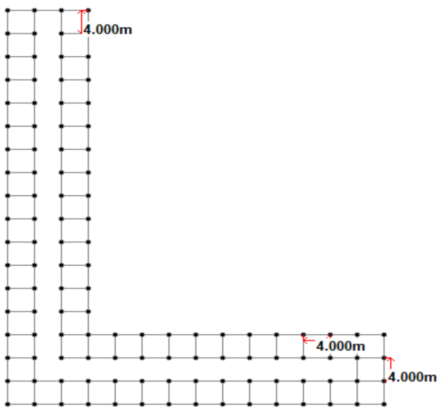


Fig.1.2 L-Shape Plan

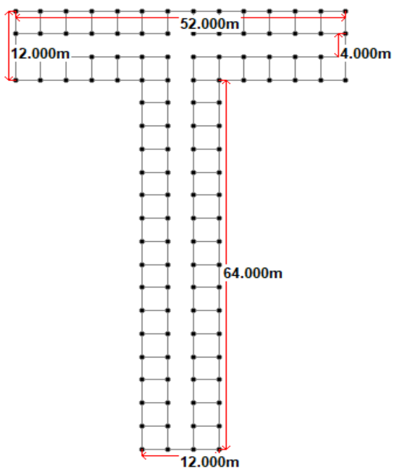


Fig.1.3 T-Shape Plan

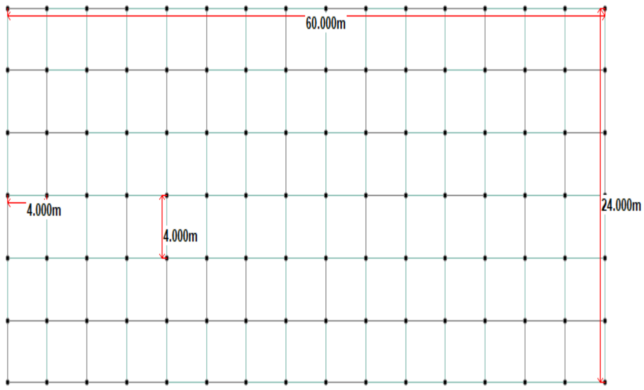


Fig.1.4: Rectangular -Shape Plan

1.3 OBJECTIVE OF WORK

Various irregular organized structures with different foundation levels are worked with locally open standard material in rough inclinations in light of nonattendance of level land in slanting regions. Because of people thickness, enthusiasm for such kind of working, in lopsided inclinations has extended. As the masses on rough zones are extending in this manner to settle that people high rise structures are required at this point in view of nonappearance of plain ground availability on lopsided zones improvement is to be done on slanting ground thusly the examination of seismic tremor safe structure on inclines with different sort of soils is required to prevent the loss of life, property during shudder ground development.

1. Comparative seismic analysis of RC frames structure on different configuration.
2. Comparative seismic analysis of RC frame structure on different soil conditions.
3. To know about the Effect on Structure due to Earthquake in Zone-IV.

2. REVIEW OF SURVEY

1.Dr. Sudhir Singh Bhaduria and DhananjayShrivastava :- He analyzed the structural behavior of multistory G+25 RCC building with different plan configuration such as I and L shape by using Linear and Dynamic analysis. He considerd the different seismic zone as Zone IV and V with different type soil condition like Soft, Medium and Hard soil conditions and analyzed the structure, lateral displacements, story drift, base shear, maximum bending moment and design results are also computed and compared for all the cases.

2AmitChakrawarty, Sourav Ray etc all {P8}[2016] – He examined four distinctive formed (W-shape, L-shape, Rectangle, Square) ten celebrated RCC building outlines are investigated utilizing ETABS v9.7.1 and SAP 2000 v14.0.0 for seismic zone 3 (Sylhet) in Bangladesh. Similar examination on the greatest removal of various formed structures because of static stacking and dynamic reaction range has been investigated. From the broke down outcomes it has been discovered that, for static burden investigation, impacts of quake power around same to all models with the exception of model-1(W-shape).W-shape has been discovered generally defenseless for seismic tremor load case. It is additionally found from the reaction range investigation that the removals for sporadic formed structure outlines are more than that of standard molded structure. The general execution of ordinary structures is discovered superior to unpredictable structures.

3.Gauri G. Kakpure, Ashok R. Mundhada 2016] – He inspected G+15 story-high structure of four very surprising shapes like Rectangular, L-shape, H-shape, and C-shape were utilized for correlation. The total models were investigated with the help of ETABS 9.7.1 rendition. Relative Dynamic Analysis for each of the four cases had been done to assess the misshaping of the structure. Working with extreme anomaly delivers more disfigurement than those with less inconsistency especially in high seismic zones. What's more, conjointly the story toppling second changes conversely with stature of the story. The story base shear for normal structure is most elevated contrasted with sporadic molded structures. Story float allowed is 0.004.times the stature of story. A Story float increment with increment in tallness of the story up to seventh story coming to most extreme worth and afterward it again begins diminishing. The most extreme story float allowed is 0.004 x tallness of story. The distinction of estimations of dislodging among static and dynamic investigation is immaterial for lower stories however the thing that matters is expanded in higher stories and static examination gives higher qualities than dynamic investigation. Static examination isn't adequate for tall structures and it's important to give dynamic investigation. Working with re-contestant corners experienced increasingly horizontal float and decrease in base shear limit contrasted with normal structure. When contrasted with unpredictable design the story float esteem is more in the ordinary setup. Story float is expanded as stature of building expanded. The sporadic shape building experiences more twisting and subsequently normal shape building must be liked. The consequences of proportionate static examination are around uneconomical on the grounds that estimations of dislodging are higher than dynamic investigation.

4. Mohammad Noor Jan Ahmad and Prof. C. S. Sanghvi [2017] – He evaluated the L-shape plan of G+7 story fortified solid structure have been chosen. The models are dissected in two stages, in First Phase the structure is investigated without shear dividers and delicate story in Ground floor and Second Phase a similar structure is broke down with shear dividers and having delicate story in Ground floor. In the Second Phase likewise the shear dividers are added to the model in two distinct cases, to contemplate the best area of shear dividers in the structure. The models are dissected by STAAD V8i SS6 programming utilizing IBC-2012(9) code (International construction law 2012), by Linear Static Method. As the IBC-2012 Draft Code (Afghanistan Building Code-2012) is utilized for structures in Afghanistan, so the IBC-2012 code has been sleeted for investigation. The point of this paper is to examine the impact of shear dividers on delicate story and think about the reaction of sporadic structure having shear dividers with unpredictable structures without shear dividers. He watched, that relocation, story float, minutes and shear powers in pillars, minutes in segments and bolster responses decline of the structure with shear dividers and having delicate story in Ground floor when contrasted with the structures without shear dividers and having delicate story in Ground floor. By adding shear dividers to sporadic structure, by and large the impact abnormalities like delicate story float, uprooting and minutes and shear powers in shafts and moments in segments of delicate story decline altogether when contrasted with different stories. The delicate story float by adding shear dividers to the structure is diminished essentially and it decline over half in Model-1. Firmness of shear dividers in the two bearings and area of shear dividers are significant, if the shear dividers are included appropriate area and have equivalent solidness in the two headings, it will be progressively successful. Fit as a fiddle that four shear dividers were added to the model in two unique cases, the area of shear dividers in Model-1, in which two shear dividers were orchestrated in left side corner and two shear dividers were included right side inverse corner was superior to Model-2.

3. METHODOLOGY

In This research work deals with relative study of different earthquake behavior on tall building structures G+16 of different plan configuration. These building frame structure of I-shape, L-shape, T-shape and Rectangular- Shape two soil condition and two seismic zone under the Earthquake effect as per IS 1893(part I) -2002 static analysis. Comparative Analysis is done in the term of study of analysis in terms of Max. Node displacements, Max.Bending moment, Max.Storey Displacement, Max shear force and axial forces has been carried out.

In this work included various steps:

Step-1 Modeling of building frame in structure wizard with different type of soils of G+16 in I, L, T and Rectangular shape.

Step-2 Creating 3D frame structure of I-shape , L-shape ,T shape and Rectangular Shape.

Step-3 Providing seismic zone as per IS-1893 (part-I):2000

Step-4 Applied various type load and load combination

Step-5 Analysis seeing different types of building shape planes frames providing different seismic zones. Fig & Fig shows seismic load in x and z direction.

Step-6 After analysis the structure compared all the results of Max. B.M., SF. Deflection, displacement, storey displacement etc.

4. PROBLEM DISCRIPTION

In this work, the proposed building frame structure with various input parameter such as Type of Building: Reinforced Concrete Framed Structure Plan Configuration- I-Shape, T-Shape, L-Shape, Rectangular- Shape Number of Floor: G+16, Size of Column = 600mmx600mm, Beam = 450x330mm, Height of each floor = 3.5m, Thickness of Slab= 150mm, Density of RCC: 25 kN/m^3, Density of Masonry: 18.0kN/m^3

Seismic Parameter: As per IS 1893-2002

Seismic Zone- IV, Type of soil- Medium and Soft Soil, Damping = 5% (as per table-3 clause 6.4.2), ,Zone factor for zone IV, Z=0.24, Importance Factor I=1.5 (Important structure as per Table-6), Response Reduction Factor R=5 for Special RC moment resisting frame (Table-7), Sa/g= Average acceleration coefficient (depend on Natural fundamental period).Live Load on typical floors = 3.0kN/m^2, Live Load seismic calculation = 0.75kN/m^2.

LOADING CONDITIONS

Following loading is adopted for analysis:-

Table 4.1: Values of dead load

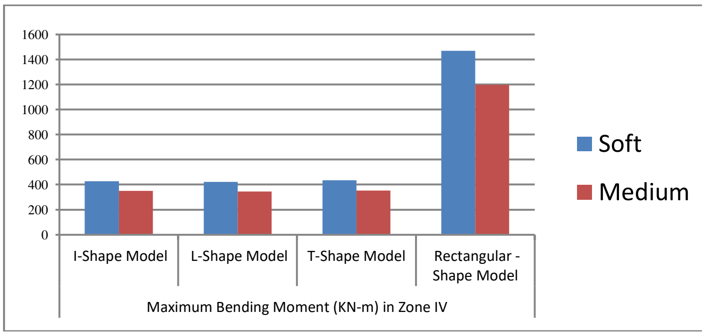
Masonry-load					Remark
For floor height 3 m	=	0.33 m x (3.5 -0 .45) m x 20kN/m^3	20.13	kN/m	
Parapet wall	=	0.23 m x (1) m x 20kN/m^3	4.6	kN/m	
Floor Load					
Slab Load	=	0.150 m x 25kN/m^3	6.25	kN/m^2	Slab thick. 150 mm assumed
Floor Finish	=		1.0	kN/m^2	
Total Load	=		7.25	kN/m^2	

5. RESULT AND ANALYSIS:

The following results are compiled and discuss below-

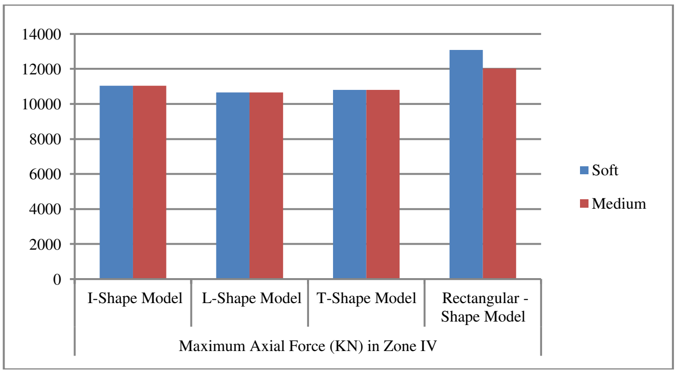
5.1 BENDING MOMENT

Soil Type	Maximum Bending Moment (KN-m) in Zone IV			
	I-Shape Model	L-Shape Model	T-Shape Model	Rectangular -Shape Model
Soft	427.149	421.07	433.476	1468.622
Medium	348.789	343.645	353.445	1196.03



5.2 AXIAL FORCE

Soil Type	Maximum Axial Force (KN) in Zone IV			
	I-Shape Model	L-Shape Model	T-Shape Model	Rectangular -Shape Model
Soft	11034.004	10651.792	10805.373	13082.229
Medium	11034.004	10651.792	10805.373	12014.7



5.3NODE DISPLACEMENT

Table 5.3.1 Node Displacement in X direction

Soil Type	Maximum displacement (mm) in X direction			
	I-Shape Model	L-Shape Model	T-Shape Model	Rectangular -Shape Model
Soft	156.708	194.607	200.949	495.048
Medium	127.625	158.548	163.654	403.195

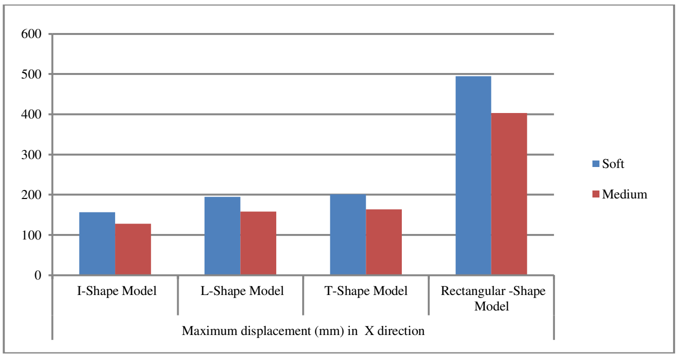


Table 5.3.2 Node Displacement in Z direction

Soil Type	Maximum displacement (mm) in Z direction			
	I-Shape Model	L-Shape Model	T-Shape Model	Rectangular -Shape Model
Soft	163.137	184.029	158.034	534.334
Medium	132.885	150.015	128.945	435.045

5.4 STOREY DISPLACEMENT

Table 5.4.1 Story Displacement in X Dir. with Soft soil

Storey	Storey Displacement (mm) in X direction in Soft Soil			
	I-Shape Model	L-Shape Model	T-Shape Model	Rectangular -Shape Model
Base	0	0	0	0
GF	6.169	6.219	6.397	21.209
1st Storey	16.689	17.458	17.952	56.692
2nd Storey	28.175	30.161	31.01	95.025
3rd Storey	39.902	43.473	44.699	133.867
4th Storey	51.675	57.128	58.755	172.611
5th Storey	63.395	70.981	73.03	210.945
6th Storey	74.972	84.902	87.394	248.577
7th Storey	86.311	98.76	101.71	285.181
8th Storey	97.318	112.414	115.833	320.39
9th Storey	107.87	125.714	129.603	353.791
10th Storey	117.819	138.501	142.855	384.927
11th Storey	127.022	150.608	155.411	413.299
12th Storey	135.326	161.859	176.083	438.362
13th Storey	142.565	172.07	177.671	459.535
14th Storey	148.571	181.045	186.962	476.225
15th Storey	153.223	188.578	194.74	487.905
16th Storey	156.708	194.607	200.949	495.048

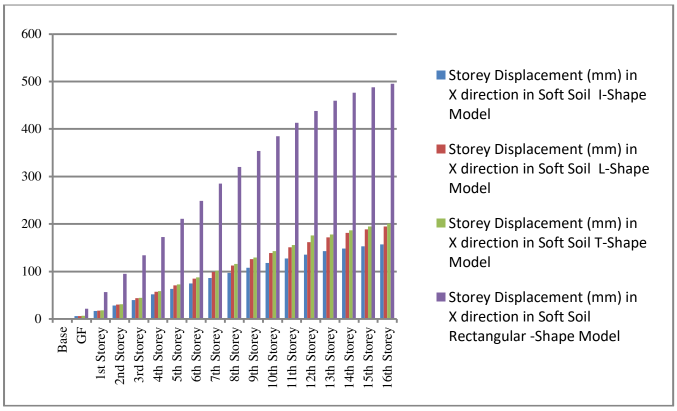


Table 5.4.2 Story Displacement in Z Dir. with Soft soil

Storey	Storey Displacement (mm) in Z direction in Soft Soil			
	I-Shape Model	L-Shape Model	T-Shape Model	Rectangular -Shape Model
Base	0	0	0	0
GF	6.176	6.225	6.216	21.059
1st Storey	16.729	16.798	16.724	56.98
2nd Storey	28.344	29.011	28.202	96.283
3rd Storey	40.29	41.778	39.939	136.538
4th Storey	52.353	54.83	51.74	177.057
5th Storey	64.419	68.024	63.504	217.472
6th Storey	76.389	81.237	75.136	257.444
7th Storey	88.158	94.345	86.538	296.609
8th Storey	99.611	107.217	97.602	334.562
9th Storey	110.62	119.714	108.203	370.857
10th Storey	121.046	131.692	118.206	405.006
11th Storey	130.742	142.997	127.471	436.48
12th Storey	139.546	153.475	135.84	464.711
13th Storey	147.291	162.966	143.149	489.096
14th Storey	153.802	171.313	149.262	509.027
15th Storey	159.001	178.355	154.148	523.983
16th Storey	163.137	184.029	158.034	534.193

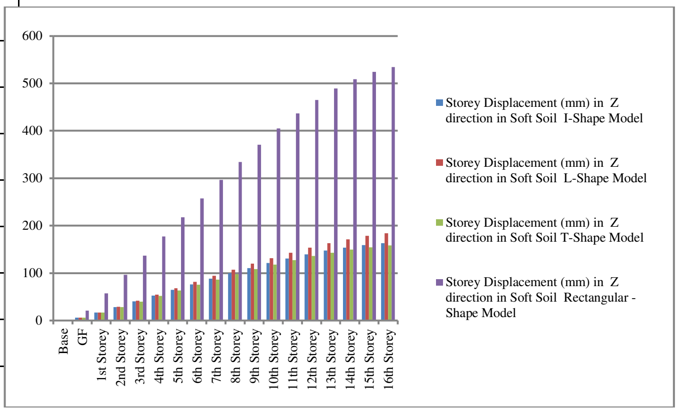


Table 5.4.3 Story Displacement in X Dir. with Medium soil

Storey	Storey Displacement (mm) in X direction in Medium Soil			
	I-Shape Model	L-Shape Model	T-Shape Model	Rectangular -Shape Model
Base	0	0	0	0
GF	5.26	5.067	5.21	17.272
1st Storey	13.593	14.223	14.62	46.169
2nd Storey	22.947	24.573	25.254	77.388
3rd Storey	32.497	35.418	36.402	109.019
4th Storey	42.085	46.542	47.848	140.571
5th Storey	51.629	57.828	59.474	171.789
6th Storey	61.056	69.71	71.171	202.436
7th Storey	70.291	80.46	82.83	232.245
8th Storey	79.253	91.584	94.331	260.918
9th Storey	87.846	102.419	105.545	288.119
10th Storey	95.948	112.837	116.337	313.475

11th Storey	103.443	122.7	126.562	336.58
12th Storey	110.206	131.866	136.067	356.99
13th Storey	116.101	140.183	144.69	374.233
14th Storey	120.992	147.493	152.257	387.825
15th Storey	124.783	153.632	158.592	397.336
16th Storey	127.625	158.548	163.654	403.195

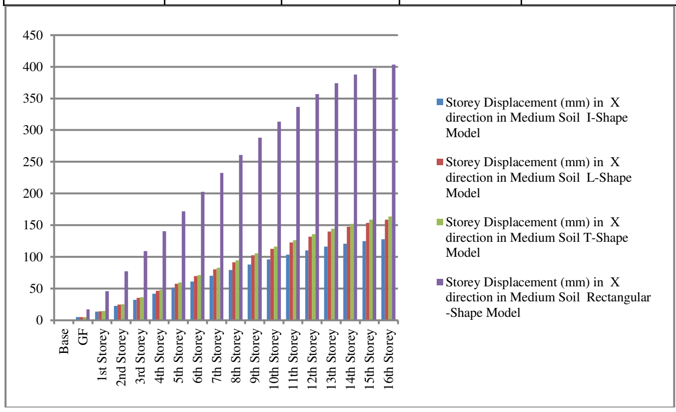
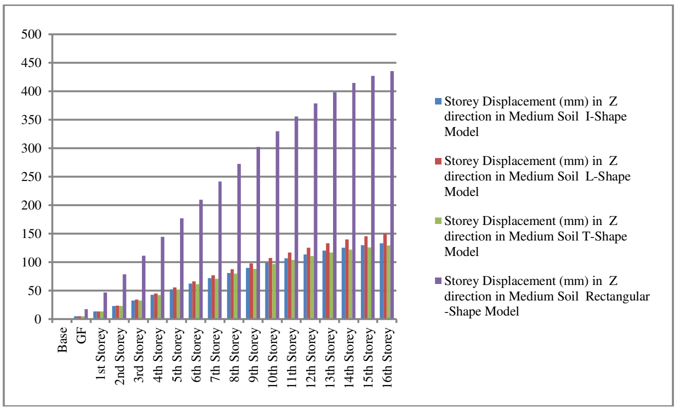


Table 5.4.4 Story Displacement in Z Dir. with Medium soil

Storey	Storey Displacement (mm) in Z direction in Medium Soil			
	I-Shape Model	L-Shape Model	T-Shape Model	Rectangular -Shape Model
Base	0	0	0	0
GF	5.03	5.073	5.064	17.15
1st Storey	13.624	13.69	13.623	46.404
2nd Storey	23.084	23.643	22.976	78.411
3rd Storey	32.813	34.048	32.543	111.193
4th Storey	42.636	44.686	42.165	144.191
5th Storey	52.462	55.439	51.758	177.103
6th Storey	62.21	66.209	61.246	209.655
7th Storey	71.795	76.894	70.55	241.55
8th Storey	81.121	87.387	79.578	272.458
9th Storey	90.086	97.575	88.23	302.016
10th Storey	98.577	107.34	96.397	329.826
11th Storey	106.473	116.558	103.964	355.457
12th Storey	113.643	125.1	110.802	378.447
13th Storey	119.95	132.837	116.777	398.306
14th Storey	125.252	139.641	121.776	414.537
15th Storey	129.497	145.384	125.77	426.718
16th Storey	132.885	150.015	128.945	435.045



6. CONCLUSIONS

- It is seen that the minimum displacement in medium soil condition and max in soil condition means increase the soil condition lower to higher soil condition the displacement is decreased.
- comparing the displacement by plan configuration, minimum displacement is found in I-shape model, average in L-shape model and in T-shape, maximum in Rectangular shape model. It means that the earthquake effect also depend on the plan configuration of the structures.
- comparing the Axial Force by plan configuration, minimum Axial Force is found in I-shape model, average in L-shape model and T-shape model, maximum in rectangular shape. It means that the earthquake effect also depend on the plan configuration of the structures.
- It is seen that the minimum Shear Force in medium soil condition and max in soil condition means increase the soil condition lower to higher soil condition the Shear Force is decreased.
- comparing the Shear Force by plan configuration, minimum Shear Force is found in I-shape model, average in L-shape model and T-shape model, maximum in rectangular shape. It means that the earthquake effect also depend on the plan configuration of the structures.
- It is seen that the minimum bending moment in medium soil condition and max in soil condition means increase the soil condition lower to higher soil condition the bending moment is decreased.
- comparing the bending moment by plan configuration, minimum bending moment is found in I-shape model, average in L-shape model and T-shape model, maximum in rectangular shape model. It means that the earthquake effect also depend on the plan configuration of the structures.
- It is seen that the minimum storey displacement in medium soil condition and max in soil condition means increase the soil condition lower to higher soil condition the storey displacement is decreased.
- comparing the Shear Force by plan configuration, minimum storey displacement is found in T-shape model, average in I-shape model and L-shape model, maximum in rectangular

shape. It means that the earthquake effect also depend on the plan configuration of the structures.

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BIOGRAPHIES

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