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A Study of Seismic Behaviour of Multistorey Building Having in Plan Irregularity with Re-Entrant Corner Under Various Conditions

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Abstract— **Today the world is facing some of the major problems caused by 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 always be a challenge for science and Technology. In the Past few years research has been done on the various issues of Earthquake. Now a Days people live in Multi-story Buildings, in such case when the Earthquake occurs in the populated areas, it will cause massive loss of life and damage. Hence Earthquake analysis is of prime importance while analysing the structure's safety against the collapse due to earthquake and design the structure to safeguard it against Earthquake occuring during the lifetime of the structure. In this study a model of a G+18 Structure with different plan configurations like I-Shape, T-shape,L-Shape, H-Shape and Plus shape with different position of the shear wall on structures and without shear wall are taken in STAAD Pro software and the Earthquake analysis of the Structure in seismic zones III with Medium soil of India is performed. In this research work, various parameters are used like damping ratio is taken as five percent, Importance factor I = 1.5 for important building, height of each floor 3.2m, size of columns 650mm X 650mm, size of beam 500mm X 400mm, thickness of slab 150mm , thickness of shear wall 150mm etc. The comparative analysis of RC multistory building framed structure is done by Linear Static Method and Response spectrum method in the terms of Maximum Displacement, Maximum Bending Moment, Maximum Shear Force, Maximum Axial Forces, Story wise Displacement, Peak Shear in different Story, etc.**

Keywords— Seismic Zone, RC Building, Soil, Staad Pro, Plan Configuration etc.

I. INTRODUCTION

With advent of modern structural engineering practices the demand for creating function specific structures has increased a lot thereby putting a lot of stress on the modern day structural engineer to create structures which may not be structurally ideal but are function specific. This practice leads to the creation of structures which are asymmetrical and having various types of plan and vertical irregularities. These irregularities contribute to abnormal behaviour of structure when subjected to seismic excitations. To counteract this, engineers need to pay attention to various parameters such as the storey drift, bending moment, axial forces, shear induced in the structure. In this research work we are going to mainly focus on structures having plan irregularities, to be specific we are going to focus on building configurations comprising of re-enterant corners. We are going to focus on the effects of re-enterant corners on the structural parameters and search for remedies to overcome the negative effects, also we are going to focus our study on various lateral bracing systems specially on shear walls. Earthquakes are formed due to the rupture in the plates, where rupture takes place that is the place of origin of the earthquake and that place is called as the focus or Hypocenter. The place just above the earth's surface is called as the Epicenter. The Distance from focus to Epicenter is known as the focal depth. Earthquake's size can be determined by both magnitude and Intensity, magnitude means the amount of Energy which is released when the rupture takes place.

Structures are an intricate framework and various things must be thought of. Henceforth at the arranging stage itself, draftsmen and basic specialists must cooperate to guarantee that the negative highlights are kept away from and great structure arrangement is picked. On the off chance that we have a helpless design to begin with, all that a specialist can do is to give a Band-Aid for example improve an essentially helpless arrangement and to make it ideal. Then again, on the off chance that we start off with a decent arrangement and sensible encircling framework, even a helpless architect can't hurt its definitive execution to an extreme. In any case, developments can endure assorted harms when they are put under seismic excitations, despite the fact that for the same auxiliary setup, area, EQ harms in the frameworks are neither lopsided nor homogenous. A craving to make a stylish and practically productive structure drives engineers to consider awesome and creative structures. Once in a while the state of building grabs the attention of guest, at times the basic framework offers, and in different events both shape and auxiliary framework cooperate to make the structure a Marvel. In any case, every one of these selections of shapes and structure has huge bearing on the presentation of working during solid seismic tremor. So the evenness and normality are typically suggested. The conduct of working during tremor relies fundamentally upon its general shape, size and geometry. Structures with sporadic geometry react distinctively against seismic activity. Plan geometry is the boundary which chooses its presentation against various stacking conditions. The impacts of inconsistency (in plan and shape) on structure have been done by utilizing auxiliary examination programming on STAAD Pro. V8i. Tremors, brought about by developments on the earth surface, bring about various degrees of ground shaking prompting harm and breakdown of structures and common infra-structures. The structure ought to withstand moderate degree of seismic tremor and ground movement without auxiliary harm, however perhaps with some basic just as nonstructural harm. This breaking point state may compare to tremor power

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equivalent to the most grounded either experienced or figure at the site. The outcomes are read for reaction range strategy.

1.1 SOIL PROPERTIES

Soil-Structure Interaction is a testing multidisciplinary subject which covers a few territories of Civil Designing. For all intents and purposes each development is associated with the ground and the collaboration between the ancient rarity and the establishment medium may influence significantly both the superstructure and the establishment soil. The Soil-Structure Collaboration issue has turned into a vital component of Basic Engineering with the approach of huge developments on delicate soils, for example, atomic force plants, cement plants and earth dams. Structures, scaffolds, burrows and underground structures might likewise require specific consideration to be given to the issues of Soil-Structure Interaction. Seeing how the soil reacts to effective seismic tremors could be essential to designers and planners outlining future structures to withstand the level of speeding up measured in this shudder. The data will likewise offer seismologists some assistance in developing new models to anticipate the impacts of these uncommon effects.

In this research work, different types of building plan configurations such as H-Shape, I-shape, L-Shape, T- shape and Plus (+) Shape are taken. In total 20 models are analyzed with and without shear wall by Linear Static Method and Response Spectrum Method. Spacing of 4.5m along to X and Z direction respectively with G+18, each floor height is 3.2m, size of column 650mm x 650 mm, size of beam 500mm x 400mm, thickness of slab 150mm, thickness of shear wall 150mm are used in this research work. Building is located in seismic zone III in the Medium soil.

Building Configurations :-

I-Shape Building Configuration Without Shear wall:-

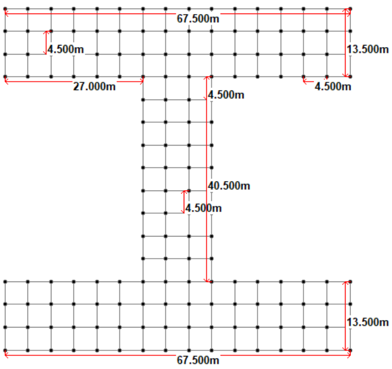

Fig 1a: I-Shape Plan WSW

I-Shape Building Configuration With Shear Wall :-

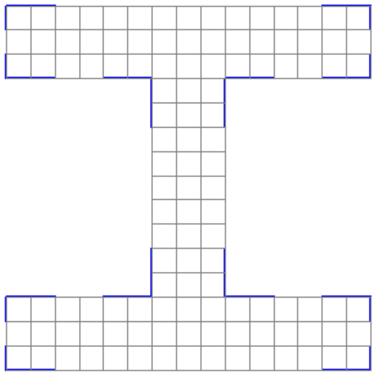

Fig 1b: I-Shape with SW

T-Shape Building Configuration Without Shear wall:-

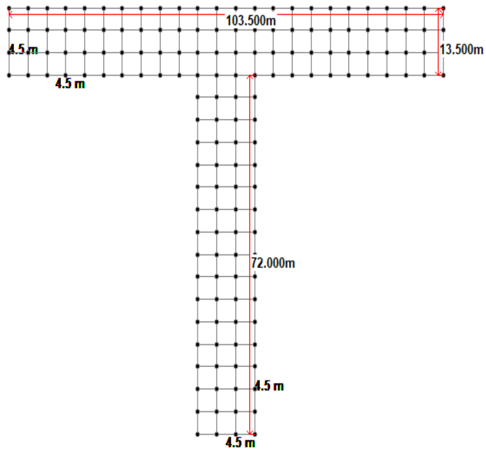

Fig. 2a: T-Shape

T-Shape Building Configuration With Shear wall:-

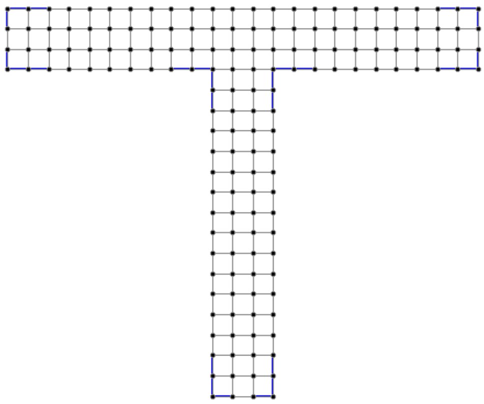

Fig. 2b: T-Shape with SW

L-Shape Building Configuration Without Shear wall:-

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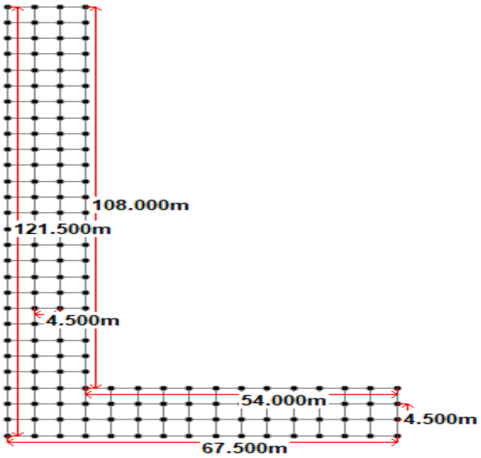

Fig. 3a: L-Shape

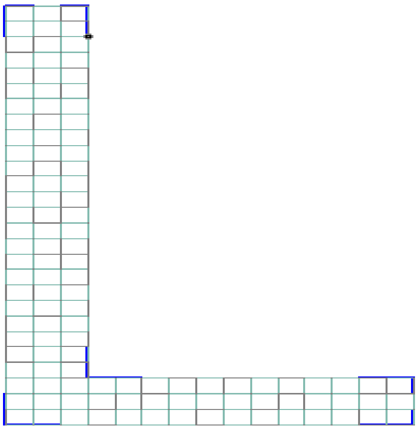

Fig. 3b: L-Shape with SW

H-Shape Building Configuration Without Shear wall:-

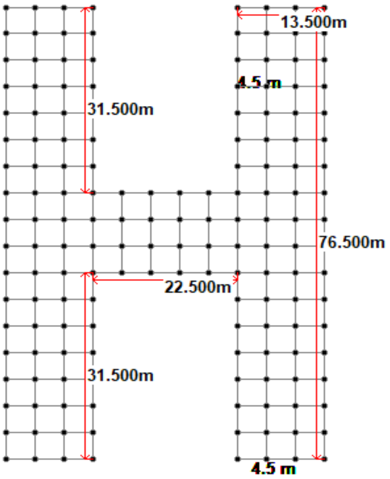

Fig 4a: H-Shape

H-Shape Building Configuration With Shear wall:-

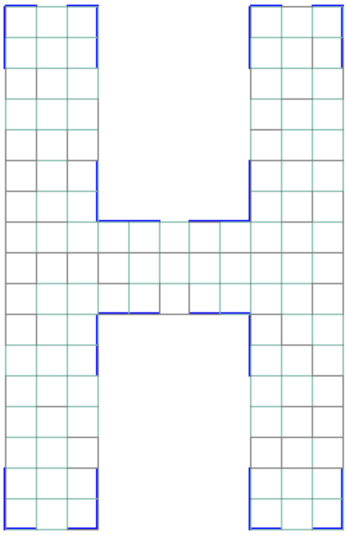

Fig 4b: H-Shape with SW

+ Shape Building Configuration Without Shear wall:-

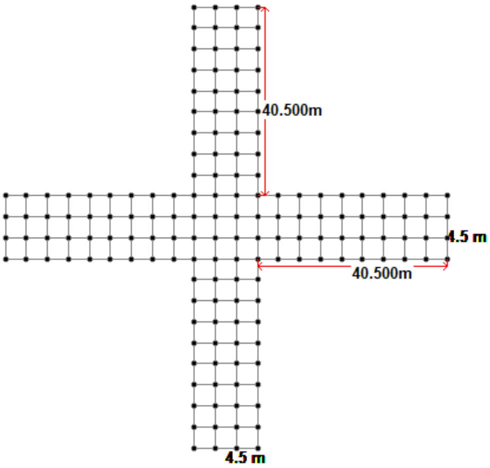

Fig. 5a: PLUS Shape

+ Shape Building Configuration With Shear wall:-

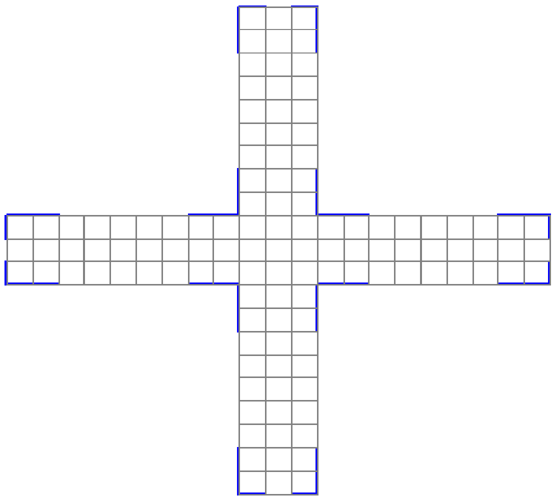

Fig. 5b: PLUS Shape with SW

II. LITERATURE SURVEY

Dr. P. P. Saklecha etc. al [2018]:- He studied that the Seismic analysis of RC multistory building with different seismic zone with different shapes of building plan such as rectangular shape plan, C-shape Plan, L-shape plan and H-shape plan by using Staad Pro. He analyzed the structure in all types of soil as per the Indian Standard code IS:1893:2002 by Response spectrum method and time history method. He observed that the maximum storey drift was present in L-shape, maximum bending in H-shape, maximum axial force in H-shape while minimum storey drift and displacement in rectangular shape. Amit Chakrawarty, Sourav Ray et al [2016] – They examined four distinctive model (W-shape, L-shape, Rectangle, Square) RCC building outlines, 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. Dr. Shaik Yajdani and Girum Mindaye et al. 2016 – Analyzed the structural system to find the deformations and forces induced by applied loads or ground excitation is an essential step in the design of a structure to resist earthquake. There is a range of methods from a linear analysis to a sophisticated nonlinear analysis depending on the purpose of the analysis in the design process. He analyzed the seismic response of a residential G+10 RC frame building by the linear analysis approaches of Equivalent Static Lateral Force and Response Spectrum methods using ETABS Ultimate 2015 software as per the IS1893-2002-Part-1. He carried out his analysis by considering different seismic zones, medium soil type for all zones and for zone II & III using OMRF frame type and for those of the rest zones using OMRF & SMRF frame types. Different response like lateral force, overturning moment, storey drift, displacements, base shear were compared and the results of the static and dynamic analysis were observed, It was found that the Equivalent static lateral force method gives higher values of forces and moments which makes building uneconomical hence consideration of response spectrum method is also needed.

2.2 OBJECTIVE

Following are the objectives of the study:

1) Comparative Seismic Analysis of Structure on medium types of Soil present in zone III in India.

2) Comparative Seismic Analysis of Structures having re-entrant corners and having symmetrical and asymmetrical plan configuration.

3) To know about the Effect of various positions of shear wall on the seismic parameters.

4) Compare the results of Linear Static and Response Spectrum Analysis of Structure in the given conditions.

5)Parameters to be compares in Linear Static and Response Spectrum Analysis are the storey drift, Maximum Bending moments, Maximum Shear Force, Maximum Axial Force, etc in different shape configurations.

III. METHODOLOGY

In order to study the influences of re-entrant configuration of building during earthquake and to meet the objectives as mentioned in previous chapter following steps will be adopted :

1. Analysis will be carried out by solving the different re-entrant configuration of symmetrical and asymmetrical plan building by using STAAD Pro Software.
2. The effect of earthquake/seismic forces on shear forces and bending moments in columns and drift of various floors in models having re-entrant configuration will be studied.
3. The effect on shear forces, bending moments and drift as a result of providing the various remedies (lateral load resisting elements/shear wall) will be studied.
4. Results Analysis: Graphical analysis in the term of Max B.M, Max S.F. Max Axial Forces, Deflection and Displacement etc will be used to draw conclusions from the study.

IV. MODELLING AND PROBLEM FORMULATION

MODELLING OF BUILDING FRAMES

STAAD.Pro is a general purpose program for doing the analysis of the structure with different soil conditions and present in different seismic zones. The following two activities must be performed to achieve that goal

a. Model generation using STAAD.Pro software.
b. The calculations to determine the analytical results.

Parameters Used :
Type of Building : Reinforced Concrete Framed Structure
Number of Floors: G+18

Size of Columns: 650mmx650mm
Size of Beam: 500x400mm
Height of each floor: 3.2m
Thickness of Slab: 150mm
Thickness of Shear wall: 150mm
Materials used : Concrete material is used for all models
Seismic Parameters: As per IS 1893-2016
Seismic Analysis Method: Linear Static Method
Software Used: All seismic analysis performed by using Staad Pro
Seismic Zone: III
Type of soil: Medium Soil
Damping: 5% (as per table-3 clause 6.4.2), Zone factor for zone III, 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)
LOADING CONDITIONS
Following loading is adopted for analysis:
Table 1: Values of dead load

Masonry-load					Remark
For floor height 3.2 m	=	0.23 m x (3.2 -0 .50) m x 20kN/m^3	12.24	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
Floor Finish	=		1.0	kN/m^2	
Total Load	=		7.25	kN/m^2	
Shear Wall	=	0.150 m x 25kN/m^3	6.25	kN/m^2	SW thick. 150 mm

(b) Live Loads: as per IS: 875 (part-2) 1987
Live Load on typical floors = 3.0kN/m2
Live Load seismic calculation = 0.75kN/m2

(c) Earth Quake Loads: All frames are analyzed in zone III earthquake zones
The seismic load calculation are as per IS: 1893 (2016)

LOAD COMBINATIONS

Table 2: Load Combination

LOAD CASE NO.	LOAD CASE
1	DL
2	LL
3	EQ.X
4	E.Q..Z
5	1.5(DL+LL)
6	1.5(DL+E.Q..X)
7	1.5(DL-E.Q..X)
8	1.5(DL+E.Q..Z)
9	1.5 (DL-E.Q..Z)
10	1.2(DL+LL+E.Q..X)
11	1.2 (D.L+L.L-E.Q..X)
12	1.2 (DL+LL+E.Q..Z)
13	1.2 (DL+LL-E.Q..Z)

V. COMPARITIVE RESULTS

1 DISPLACEMENT

1.1 Displacement (mm) in X direction

Table 1.1: Displacement in X direction

Maximum Displacement (mm) in X Direction		
MODEL	Without Shear Wall	With Shear Wall
H-Shape	83.744	**50.137**
I-Shape	75.018	54.317
L-Shape	98.964	81.498
T-Shape	100.39	84.572
PLUS-Shape	30.999	50.501

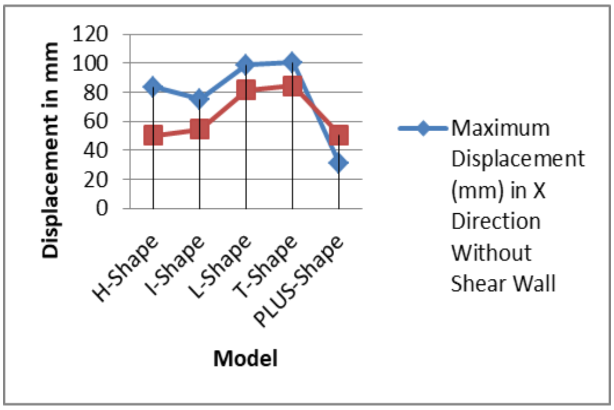

Fig 1.1: Displacement in X direction

It is observed that minimum displacement in Plus shape, while maximum in T-shape model and average in remaining models in without bracing model while minimum in H-shape model, maximum in T-shape model and average in other remaining models with shear wall. As compare to shear wall, maximum displacement in without shear wall and least in with shear wall models. It means that if we provide shear wall, building structure is more stable as compared to without shear wall structure.

1.2 Displacement (mm) in Z direction :

Table 1.2: Displacement in Z direction

Maximum Displacement (mm) in Z Direction		
MODEL	Without Shear Wall	With Shear Wall
H-Shape	**73.055**	**43.775**
I-Shape	81.335	62.173
L-Shape	87.801	69.228
T-Shape	85.135	76.424
PLUS-Shape	28.661	52.221

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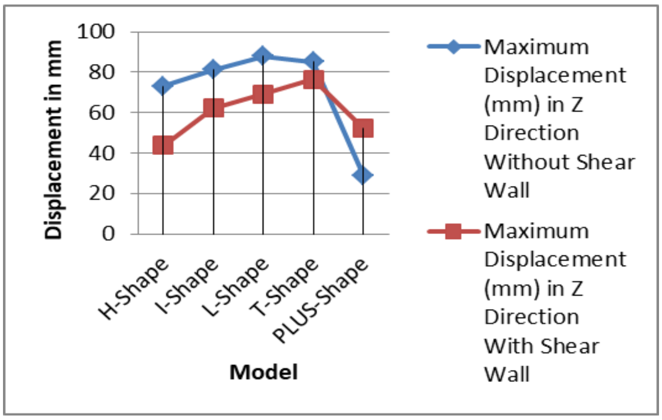

Fig 1.2: Displacement in Z direction

It is found that minimum displacement in Plus shape, maximum in T-shape model and average in remaining models in without bracing model while minimum in H-shape model, maximum in T-shape model and average in other remaining models with shear wall. As compared to shear wall, maximum displacement in without shear wall models and least in with shear wall models. It means that if we provide shear wall, building structure becomes more stable as compare to without shear wall structure.

2. AXIAL FORCE

Table 2.1: Axial force

Maximum Axial Force in KN		
MODEL	**Without Shear Wall**	**With Shear Wall**
H-Shape	12918.664	12342.911
I-Shape	12917.793	13523.225
L-Shape	15016.464	12928.366
T-Shape	11925.173	12878.067
PLUS-Shape	13529.617	12590.667

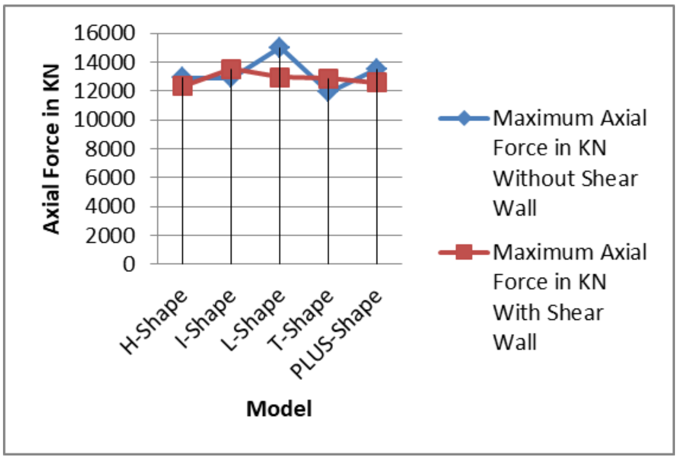

Fig 2.1: Axial force

It is observed that the maximum axial force is found in L-shape model and minimum in T-shape model without shear wall while in all other models axial forces are average while maximum axial force is found in I-shape and minimum in H-shape with shear wall models, while in other models average axial force. On comparing, maximum axial force is found in with shear wall models and minimum in without shear wall models.

3 BENDING MOMENT

Table 3.1: Bending moment in KN-m

Maximum Bending Moment in KN-m		
MODEL	**Without Shear Wall**	**With Shear Wall**
H-Shape	311.173	402.362
I-Shape	308.096	409.935
L-Shape	292.196	400.969
T-Shape	263.125	441.537
PLUS-Shape	381.125	400.514

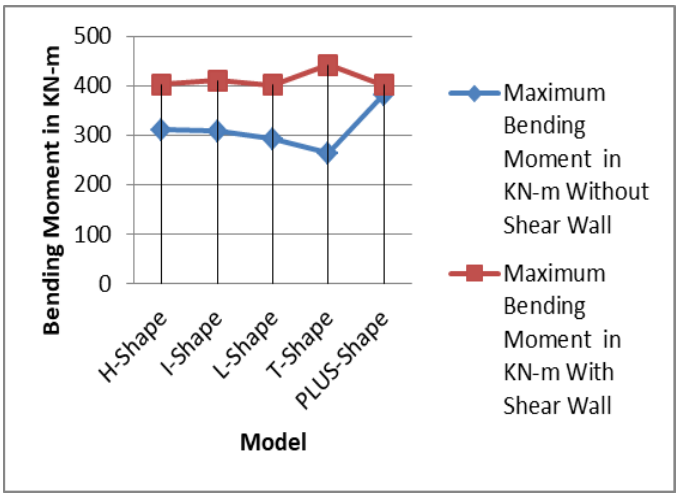

Fig 3.1: Bending moment

It is found that the maximum bending moment is present in PLUS shape model and minimum in T –shape model in without shear wall models and average in all other models similarly maximum bending moment in PLUS shape model and minimum in T –shape model in with shear wall models and average in all other models.On comparing all models, minimum bending moment is found in with shear wall models and maximum in without shear wall model. It means that with shear wall models are more stable as compared to without shear wall models.

4 SHEAR FORCE

Table 4.1: Shear Force KN

Maximum Shear Force in KN		
MODEL	**Without Shear Wall**	**With Shear Wall**
H-Shape	213.868	277.968
I-Shape	213.634	227.13
L-Shape	140.174	234.827
T-Shape	158.242	248.394
PLUS-Shape	233.072	227.39

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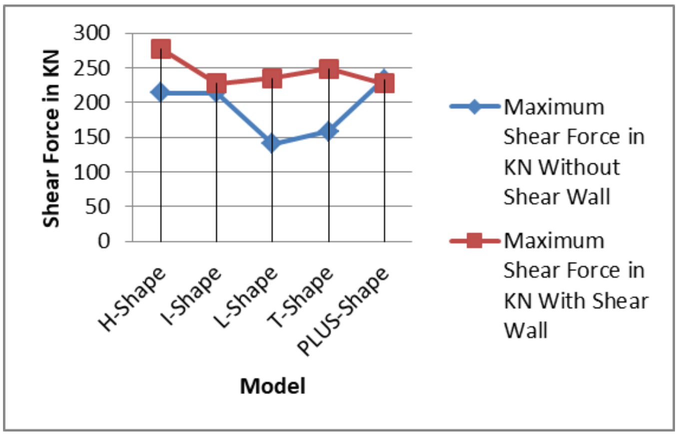

Fig 4.1: Shear Force KN

It is seen that the minimum shear force is present in L-shape model and maximum in PLUS shape model in without shear wall models, while in other models shear force is average while minimum in I-shape model and maximum axial force in H-shape model,while other models have average shear force in with shear wall. As compared to shear wall, minimum shear force in without shear wall models and maximum in with shear wall models.

5 STORYWISE DISPLACEMENTS

5.1.1 Story Wise Displacements in X Direction in Without Shear Wall

Table 5.1.1: Story Wise Displacements in X Direction

Maximum Story wise Displacement (mm) in X Direction Without Shear Wall					
Storey	H-Shape	I-Shape	L-Shape	T-Shape	PLUS-Shape
Base	0	**0**	0	0	0
GF	2.642	2.639	2.748	2.947	0.938
1	7.26	7.184	7.774	8.062	2.539
2	12.41	12.17	13.54	13.79	4.298
3	17.75	17.26	19.56	19.79	6.109
4	23.18	22.38	25.77	22.96	7.999
5	28.65	27.48	32.05	32.24	9.954
6	34.13	32.53	38.41	38.6	11.92
7	39.58	37.52	44.79	44.99	13.89
8	44.96	42.4	51.14	51.35	15.84
9	50.22	47.13	57.41	57.62	17.76
10	55.31	51.67	63.52	63.76	19.63
11	60.18	55.95	69.43	69.69	21.44
12	64.77	59.98	75.06	75.37	23.17
13	69.03	63.65	80.35	80.72	24.8
14	72.89	66.9	85.21	85.67	26.32
15	76.29	69.69	89.56	90.15	27.71
16	79.25	71.95	93.32	94.08	28.97
17	81.71	73.68	96.45	97.38	30.07
18	83.74	75.02	98.96	100	31

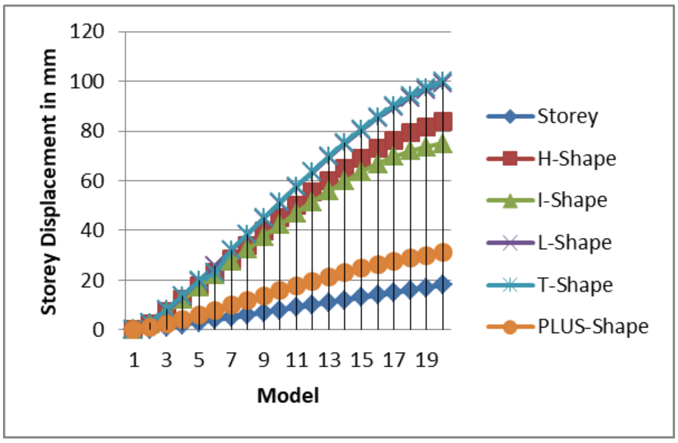

Fig 5.1.1: Story Wise Displacements in X Direction

It is seen that the maximum story displacement in T-shape and minimum in PLUS shape model while other models have average displacement in X-direction without shear wall. Story displacement in increased with increase in the height of the structure.

5.1.2 Story Wise Displacements in Z Direction in Without Shear Wall

Table 5.1.2: Story Wise Displacements in Z Direction

Maximum Storeywise Displacement (mm) in Z Direction Without Shear Wall					
Storey	H-Shape	I-Shape	L-Shape	T-Shape	PLUS-Shape
Base	**0**	0	0	0	0
GF	2.635	2.648	2.668	3.013	0.921
1	7.157	7.246	7.232	7.903	2.477
2	12.1	12.35	12.21	13.16	4.177
3	17.14	17.62	17.36	18.57	5.926
4	22.19	22.96	22.87	24.03	7.776
5	27.21	28.34	28.48	29.52	9.641
6	32.18	33.7	34.13	34.99	11.51
7	37.07	39.02	39.79	40.42	13.37
8	41.84	44.26	45.41	45.76	15.2
9	46.44	49.36	50.94	50.96	16.99
10	50.85	54.29	56.33	55.99	18.72
11	55.01	58.99	61.53	60.85	20.39
12	58.88	63.41	66.49	65.49	21.96
13	62.39	67.49	71.15	69.81	23.43
14	65.5	71.17	75.44	73.76	24.77
15	68.14	74.39	79.32	77.29	25.98
16	70.24	77.15	82.7	80.37	27.03
17	71.77	76.44	85.53	82.98	27.92
18	73.06	81.34	87.8	85.14	28.66

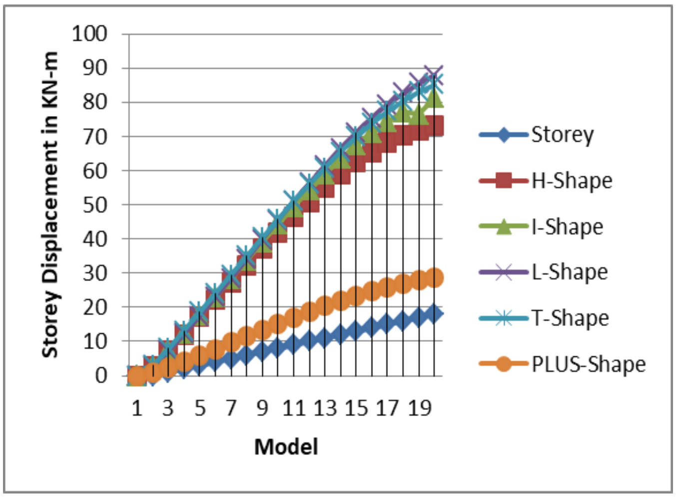

Fig 5.1.2: Story Wise Displacements in Z Direction

It is seen that the maximum story displacement is in H-shape and minimum in PLUS shape model while other models have average displacement in Z-direction without shear wall.

5.2.1 Story Wise Displacements in X Direction in With Shear Wall

Table 5.2.1: Story Wise Displacements in X Direction

Maximum Story wise Displacement in X Direction With Shear Wall					
Storey	**H-Shape**	**I-Shape**	**L-Shape**	**T-Shape**	**PLUS-Shape**
Base	0	**0**	0	0	0
GF	1.385	1.467	1.909	1.915	1.408
1	3.222	3.29	4.975	4.753	3.143
2	5.374	5.432	8.735	8.24	5.128
3	7.79	7.812	12.81	12.27	7.38
4	10.44	10.48	17.15	16.72	9.861
5	13.26	13.36	21.73	21.51	12.54
6	16.22	16.4	26.53	26.54	15.48
7	19.27	19.57	31.49	31.74	18.55
8	22.37	22.83	36.58	37.05	21.7
9	25.48	26.13	41.74	42.4	24.89
10	28.59	29.48	46.85	47.73	28.08
11	31.34	32.81	51.86	52.98	31.24
12	34.6	36.1	56.73	58.12	34.34
13	37.48	39.35	61.41	63.08	37.37
14	40.23	42.51	65.88	67.85	40.28
15	42.86	45.59	70.13	72.39	43.07
16	45.41	48.57	74.14	76.67	45.7
17	47.83	51.46	77.93	80.72	48.17
18	50.14	54.32	81.5	84.57	50.5

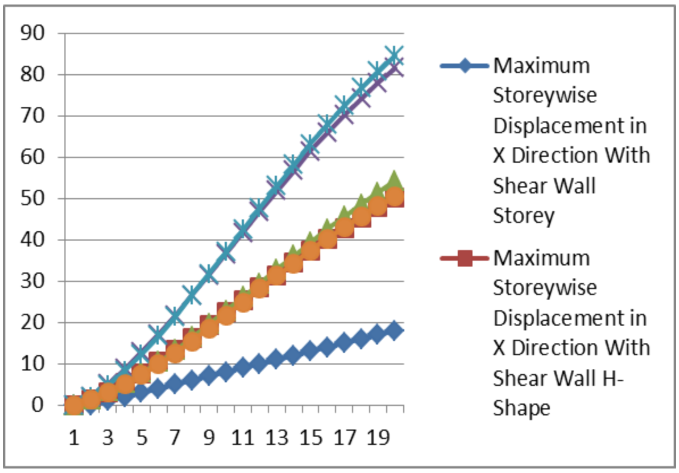

Fig 5.2.1: Story Wise Displacements in X Direction

It is found that the maximum story displacement is in T-shape and minimum in H-shape model while other models have average displacement in X-direction with shear wall.

5.2.2 Story Wise Displacements in Z Direction in Without Shear Wall

Table 5.2.2: Story Wise Displacements in Z Direction

Maximum Storeywise Displacement in Z Direction With Shear Wall					
Storey	**H-Shape**	**I-Shape**	**L-Shape**	**T-Shape**	**PLUS-Shape**
Base	**0**	0	0	0	0
GF	1.167	1.682	1.681	1.987	1.403
1	2.665	3.953	3.943	4.599	3.139
2	4.383	6.594	6.894	7.749	5.168
3	6.329	9.585	10.182	11.291	7.484
4	8.476	12.864	13.826	15.182	10.043
5	10.792	16.37	17.77	19.359	12.863
6	13.246	20.047	21.916	23.771	15.907
7	15.809	23.84	26.196	28.35	19.08
8	18.444	27.699	30.554	33.044	22.336
9	21.118	31.578	34.937	37.8	25.634
10	23.803	35.432	39.298	42.573	28.939
11	26.468	39.225	43.593	47.31	32.216
12	29.09	42.924	47.781	51.968	35.434
13	31.697	46.502	51.826	56.502	38.568
14	34.236	49.934	55.699	60.876	41.592
15	36.697	53.201	59.38	65.046	44.484
16	39.089	56.31	62.862	68.951	47.223
17	41.426	59.309	66.141	72.513	49.792
18	43.775	62.173	69.228	76.424	55.221

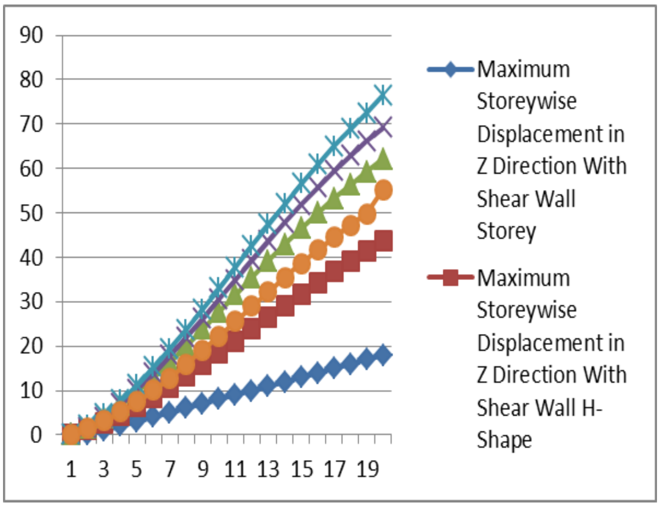

Fig 5.2.2: Story Wise Displacements in Z Direction

It is found that the maximum story displacement is in T-shape and minimum in H-shape model while other models have average displacement in Z-direction with shear wall.

VI. CONCLUSION

DISPLACEMENT :

- It is observed that minimum displacement in PLUS – shape i.e 0.938 mm , maximum in T-shape model i.e 100 mm and average in remaining models without bracing model/shear wall in X direction.
- While minimum in H-shape model i.e 1.385 mm, maximum in T-shape model i.e 84.57 mm and average in other remaining models with shear wall.
- As compared to shear wall, maximum displacement is present in without shear wall models and least in models having shear wall. It means that if we provide shear wall, building structure becomes more stable as compared to without shear wall structure.
- It is found that minimum displacement is there in Plus shape i.e 0.921 mm, maximum in T-shape model i.e 85.14 mm and average in remaining models without bracing model in Z-direction.
- While minimum in H-shape model i.e 1.385 mm, maximum in T-shape model i.e 84.57 mm and average in other remaining models with shear wall.
- As compare to shear wall, maximum displacement is present in without shear wall models and least in with shear wall models. It means that if we provide shear wall, building structure is more stable as compare to without shear wall structure.

AXIAL FORCE

- It is observed that the maximum axial force is there in L-shape model i.e 15016.464 KN and minimum in T-shape model i.e 11925.173 KN in case of models without shear wall while in other models axial forces are average.
- While maximum axial force is found in I-shape i.e 13523.225 KN and minimum in H-shape model i.e 12342.911 KN with shear wall, while in other models average axial force is present.
- As compared to models without shear wall maximum axial force is found in models with shear wall.

BENDING MOMENT

- It is found that the maximum bending moment is there in PLUS shape model i.e 381.125 KN and minimum in T –shape model i.e 263.125 KN in case of models without shear wall and average in all other models.
- Similarly maximum bending moment in T-shape model i.e 441.537 KN and minimum in PLUS–shape model i.e 400.514 KN in models with shear wall and average in other models.
- In entire model with shear wall, minimum bending moment in found and maximum in without shear wall models.
- It means that with shear wall, models are more stable as compared to without shear wall models.

SHEAR FORCE

- It is seen that the minimum shear force is present in L-shape model i.e 140.174 KN and maximum in PLUS shape model i.e 233.072 KN in without shear wall models, while in other models shear force is average.
- While minimum in I-shape model i.e 227.13 KN and maximum axial force in H-shape model i.e 277.968 KN in case of models with shear wall, while other models have average shear force.
- As compared to models with shear wall, minimum shear force in without shear wall model and maximum in with shear wall models.

STORYWISE DISPLACEMENT

- It is seen that there is maximum story displacement in T-shape model and minimum in PLUS shape model while other models have average displacement in X-direction without shear wall.
- It is seen that the maximum story displacement is present in H-shape model and minimum in PLUS shape model in Z-direction without shear wall.
- It is found that the there is maximum story displacement in T-shape model and minimum in H-shape model in X-direction with shear wall.
- It is found that the maximum story displacement is there T-shape and minimum in H- shape model in Z-direction with shear wall.
- Story displacement in increased with increase in the height of the structure.

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