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EFFECT OF SEISMIC STUDY ON DIFFERENT REGULAR WITH A COMBINATION OF SHEAR WALL AND WITH OUT SHEAR WALL IN DIFFERENT ZONES

[1] Kancharla Nagaraju 2nd shaik subhani

[1]Student1st, [2]Assistant professor

[1]Department of Civil Engineering Amreddy Memorial College of engineering and technology Narasaraopeta Andhra Pradesh

[2]Department of Civil Engineering Amreddy Memorial College of engineering and technology Narasaraopeta Andhra Pradesh

Abstract: In the present study we are going to observe the difference between rectangular frame and L-shaped frame .Shear walls can be placed around the building as periphery walls, around the lift and beside the staircase in this project two different shapes of frames has been considered and compared the lateral displacement of the frames for L- Shape structure and rectangular framed structure is calculated the storey drift. And how it is varying in the different zones of Zone II, III&with different storey heights of G+ 10, G+ 15. The buildings are modelled with floor area of for rectangular frames of 30m x 30m with 10 bays along 30m span and 10 bays along 30m and each bay width of 3m and 3m of L- Shaped frame. The lateral displacement of the structure is compared in general frame, shear wall and bracing frame. The lateral displacement values of current floor level to another floor level should reach storey drift .The design loads values are calculated from the standard codes of IS 456-2000, IS 1893-2000. The analysis is done in Staadprov8i.

KEYWORDS: Seismic coefficient method, shear wall and bracings, lateral displacement, staadproV8

I. INTRODUCTION

The term 'apartment building' refers to a multi-storey building that is primarily residential in use and that has individual residential units (apartments), on all or most floors. In certain locations, such as town and metro centres, apartment buildings may have commercial uses on the ground and lower floors. In present study, the earthquake analysis of G+10, G+15, storied building was done by Equivalent static method. The main parameters considered in this study to compare the seismic performance of different Zones i.e.III, IV are lateral displacement. The building frame is modelled with a dimensions of 91m x 60m having columns & beams with a slab panel of 9m x 6m the model is made using STAAD.PRO Software. In case of building with shear wall the building frame is modelled as above dimensions only with alternate shear wall using 4 node plate proposed thickness of 150 mm along the half height of the structure. The new zone map will now have only four seismic zones – III, and IV. Seismic micro zonation accounts for local variations in geology, local soil profile, etc. In this paper to analyse a model for earthquake resisting structure. The model structure is located in Zone-II, III& IV of L –shaped frame. To calculate the lateral displacement, on buildings using seismic coefficient method. By using STAAD pro. And make a comparative analysis between general Frame & shear wall and bracing frame Structure in equivalent static method .Comparison between G+10, G+15.

1.2 OBJECTIVE

1. The model of rectangular frame & L –shaped structure is located in both Zone-II, III & IV.
2. And make a comparison between General Frame & shear wall and bracing frame structure.

1.3 SCOPE

1. Only RC buildings are considered.

2. Entire analysis is carried out using STAAD.proV8i.

3. Seismic analysis is carried out and orientation of shear walls.

4. We can do the wind analysis for the frames.

2.1 SESMIC COEFFIECIENT METHOD

As per IS 1893 (part1)-2002, Seismic Coefficient analysis Procedure is summarized in following steps

a) Design Seismic Base Shear:- The total design lateral force or design seismic base shear (V_B) along any principal direction of the building shall be determined by the following expression

V_B= Ah W

Where Ah = Design horizontal seismic coefficient

W = Seismic weight of the building.

b) Seismic Weight of Building: - The seismic weight of each floor is its full dead load plus appropriate amount of imposed load as specified. While computing the seismic weight of each floor, the weight of columns and walls in any storey shall be equally distributed to the floors above and below the storey. The seismic weight of the whole building is the sum of the seismic weights of all the floors. Any weight supported in between the storey shall be distributed to the floors above and below in inverse proportion to its distance from the floors.

c) Fundamental Natural Time Period-: The fundamental natural time period (Ta) calculates from the brick filling, then the fundamental natural period of vibration, may be taken as

$$T_a = \mathbf{0.09}\, \boldsymbol{h}/\sqrt{\boldsymbol{d}}$$

d) Distribution of Design Force: - The design base shear, V_B computed above shall be distributed along the height of the building as per the following expression

$$Q_i = V_B \frac{Wihi^2}{\sum_{j=1}^{n} Wihj^2}$$

The total base shear and lateral force is calculation by STAAD Pro

2.1 Ordinary Moment Resisting Frame

It includes the beams & columns along with fixed supports. These columns and beams are created with beam node elements and connected with beam elements of the software. Here the slab loading at each floor level is acting vertically on the slab and is calculated for square meter as its applied on the beam and the wall load is also assigned on the beams only . for horizontal loads , the physically present phenomena that the floor slab at each floor level is acting as very rigid horizontal beams which ensures that the lateral deformation of all the nodes at any particular floor level are the same. This is known as diaphragm action of the horizontal slabs.

2.2Special RC Moment Resisting Frame

It includes the columns and beams as the framing system but with four sides alternate shear walls on the structure on all the side instead of columns.

2.3 load combinations used in this project

1. DL
2. LL
3. (DL+LL)
4. 1.5(DL+LL)
5. EQX+VE
6. EQX-VE
7. EQZ+VE
8. EQZ-VE
9. 1.5(DL+ EQX+VE)
10. 1.5(DL+ EQX-VE)
11. 1.5(DL+ EQZ+VE)
12. 1.5(DL+ EQZ-VE)
13. 1.2(DL+LL+E EQX+VE)

14. 1.2(DL+LL+E EQX-VE)
15. 1.2(DL+LL+E EQZ+VE)
16. 1.2(DL+LL+E EQZ-VE)
17. 0.9 DL+1.5 EQX+VE
18. 0.9 DL+1.5 EQX-VE

2.4 CODES CONSIDERED FOR DESIGN

1. DEAD LOADS IS 875 PART 1

2. LIVE LOADS IS 875 PART 2

3. SEISMIC LOADS IS1893-2000 PART 1

4. FOR REINFORCED STRUCTURES IS 456-2000

2.5 DATA collected for analysis of RC frame building

Following data used in the analysis of the RC frame of L shaped frame.

Type of frame: RC frame (General frame of L shape and rectangular frame & L shaped frame of Shear wall)

Seismic zone : II, III

Number of Storey : G+10, G+15

Floor height : 3m

Depth of two-way slab : 0.150 m

Materials : M25 concrete, Fe500 steel

Shear wall thickness : 0.12m

Type of soil : medium

Density of concrete : 25 KN/m^2

Equivalent static method : IS-1893(part-1)2002

Damping of structure : 0.05

Shear wall thickness : 0.15m

TABLE-

ZONE II,III, IV	G+10 GENERAL FRAME	G+15 GENERAL FRAME	G+10 DUAL FRAME	G+15 DUAL FRAME
COLUMN DETAILS	0.65X0.6	0.65X0.6	0.65X0.6	0.65X0.6
BEAM DETAILS	0.6X0.55	0.6X0.55	0.6X0.55	0.6X0.55

ZONE II,III, IV	G+10 GENERAL FRAME	G+10 SHEAR WALL FRAME	G+15 GENERAL FRAME	G+15 SHEAR WALL FRAME
COLUMN DETAILS	0.65X0.6	0.65X0.6	0.65X0.6	0.75X0.7
BEAM DETAILS	0.6X0.55	0.6X0.55	0.6X0.55	0.6X0.55

RESULTS

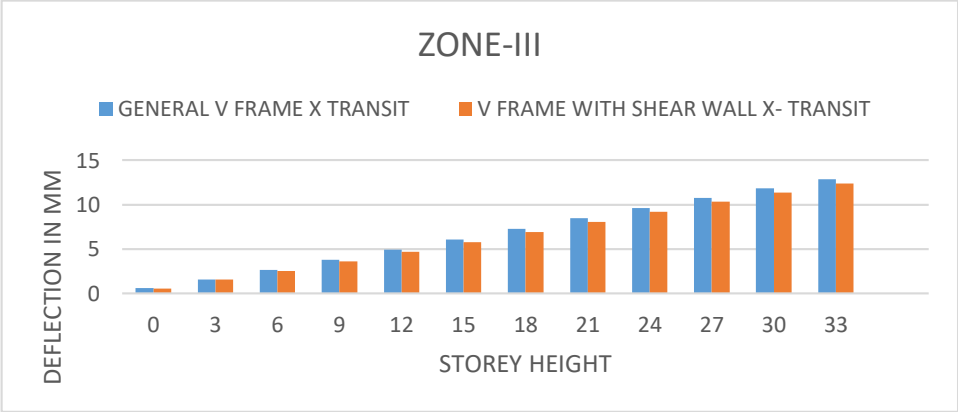
The comparative results of both General Frame & shear wall and bracing frame structure for Zone III and IV is given in Table 1 and Table 2 respectively. The Lateral displacement of structure and model mass of the structure in both ZONE-III & Zone-IV compared and the storey displacement in each level are to be compared.

ZONE-III V-SHAPED FRAME DETAILS

Table 1 The results of General frame of V-shape & V shape with Shear wall and bracing frame

S.NO	STOREY HEIGHT	GENERAL V FRAME X TRANSIT	V FRAME WITH SHEAR WALL X- TRANSIT
1	0	0.63	0.55
2	3	1.60	1.58
3	6	2.66	2.55
4	9	3.78	3.59
5	12	4.93	4.68
6	15	6.10	5.80
7	18	7.29	6.94
8	21	8.47	8.08
9	24	9.64	9.21
10	27	10.78	10.31
11	30	11.86	11.37
12	33	12.88	12.37

From above table shows the lateral Displacement Values in Transverses (X) Direction of V- SHAPED FRAME in ZONE-III of G+10.

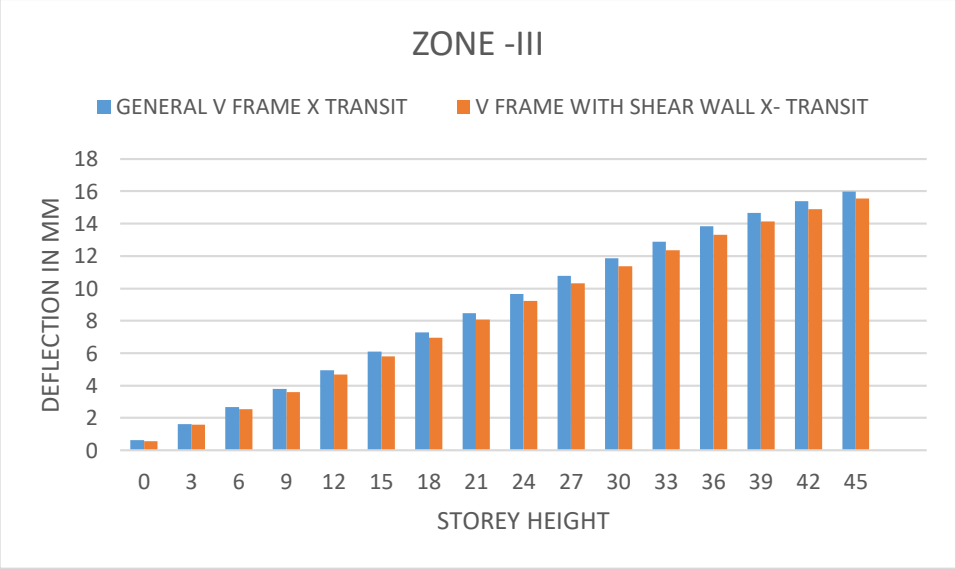


GRAPH 1: COMPARISION BETWEEN GENERAL FRAME, SHEAR WALL & BRACING OF V-SHAPED STRUCTURE IN ZONE III (G+10)

Table 2 The results of General frame of V-shape & V shape with Shear wall and bracing frame

S.NO	STOREY HEIGHT	GENERAL V FRAME X TRANSIT	V FRAME WITH SHEAR WALL X- TRANSIT
1	0	0.63	0.55
2	3	1.60	1.58
3	6	2.66	2.55
4	9	3.78	3.59
5	12	4.93	4.68
6	15	6.10	5.80
7	18	7.29	6.94
8	21	8.47	8.08
9	24	9.64	9.21
10	27	10.78	10.31
11	30	11.86	11.37
12	33	12.88	12.37
13	36	13.82	13.30
14	39	14.66	14.14
15	42	15.38	14.89
16	45	15.98	15.54

From above table shows the Storey Displacement Values in Transverses (X) Direction of V- SHAPED FRAME in ZONE-III of G+15 Storey building.



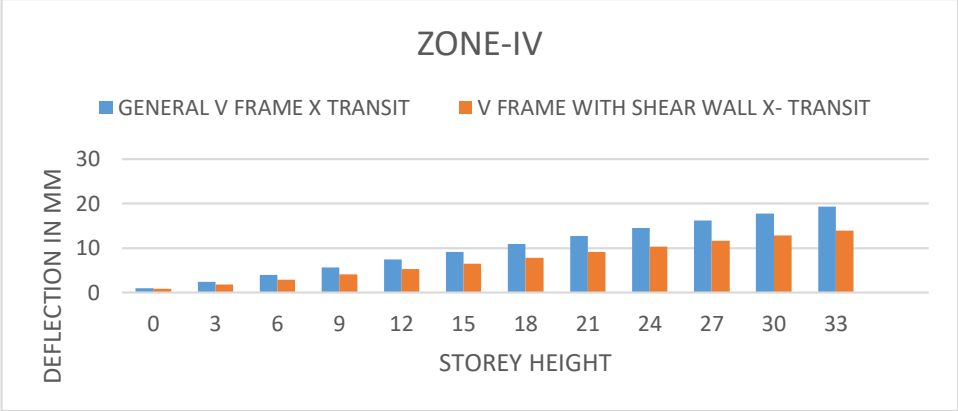
GRAPH :2 COMPARISION BETWEEN GENERAL FRAME, SHEAR WALL & BRACING OF V-SHAPED STRUCTURE IN ZONE III (G+15)

ZONE IV

Table 3 The results of General frame of V-shape & V shape with Shear wall and bracing frame

S.NO	STOREY HEIGHT	GENERAL V FRAME	V FRAME WITH SHEAR WALL
		X TRANSIT	X- TRANSIT
1	0	0.95	0.78
2	3	2.40	1.77
3	6	4.00	2.87
4	9	5.67	4.04
5	12	7.39	5.27
6	15	9.15	6.53
7	18	10.93	7.81
8	21	12.71	9.10
9	24	14.46	10.37
10	27	16.17	11.60
11	30	17.80	12.79
12	33	19.33	13.92

From above table shows the Storey Displacement Values in Transverses (Z) Direction in ZONE-IV of G+10 Storey building

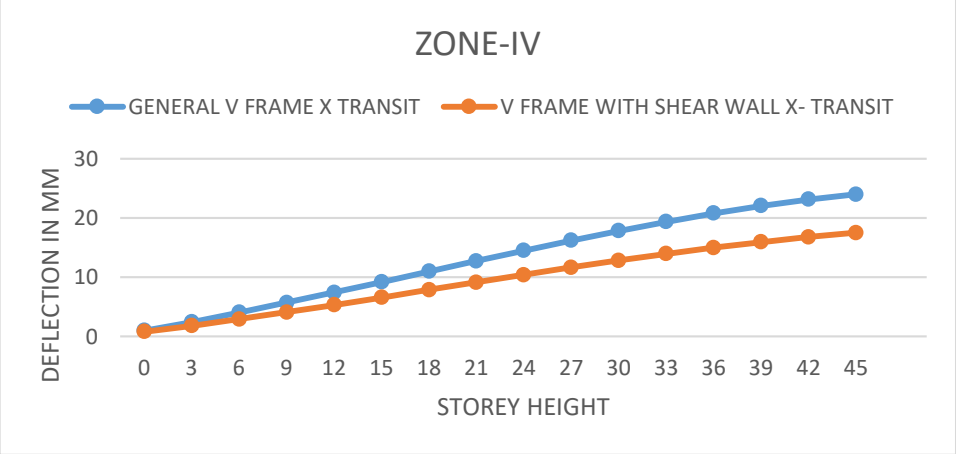


GRAPH 3: COMPARISION BETWEEN GENERAL FRAME, SHEAR WALL & BRACING OF V-SHAPED STRUCTURE IN ZONE IV (G+10)

Table 4 The results of General frame of V-shape & V shape with Shear wall and bracing frame

S.NO	STOREY HEIGHT	GENERAL V FRAME	V FRAME WITH SHEAR WALL
		X TRANSIT	X- TRANSIT
1	0	0.95	0.78
2	3	2.40	1.77
3	6	4.00	2.87
4	9	5.67	4.04
5	12	7.39	5.27
6	15	9.15	6.53
7	18	10.93	7.81
8	21	12.71	9.10
9	24	14.46	10.37
10	27	16.17	11.60
11	30	17.80	12.79
12	33	19.33	13.92
13	36	20.74	14.96
14	39	21.99	15.91
15	42	23.08	16.75
16	45	23.97	17.48

From above table shows the Storey Displacement Values in Transverses (X) Direction in ZONE-IV of G+15 Storey building.



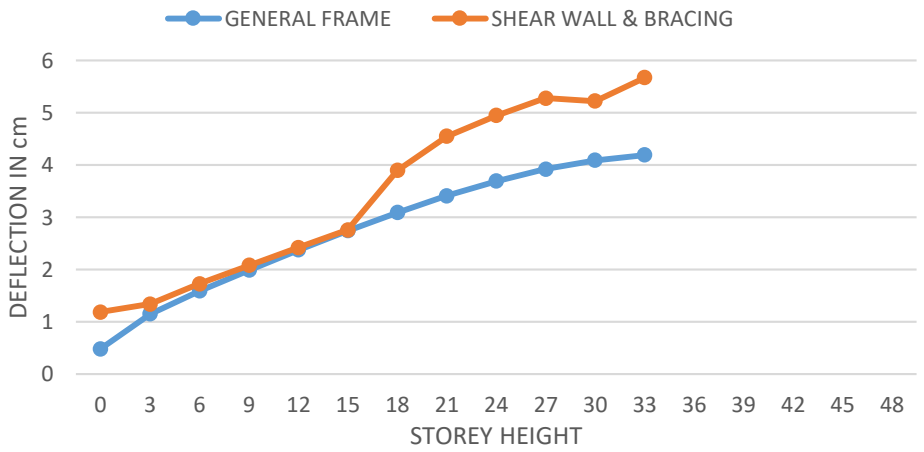
GRAPH 4 : COMPARISION BETWEEN GENERAL FRAME, SHEAR WALL & BRACING OF V-SHAPED STRUCTURE IN ZONE IV (G+15)

ZONE III C-SHAPED FRAME

Table 5 The results of General frame of C-shape & C shape with Shear wall and bracing frame

S.No	Storey Height	Lateral displacement in cm	
		General frame of C-shape	C shape with Shear wall and bracing frame
1	0	0.48	1.18
2	3	1.14	1.33
3	6	1.58	1.72
4	9	1.98	2.07
5	12	2.37	2.42
6	15	2.74	2.75
7	18	3.08	3.89
8	21	3.41	4.55
9	24	3.69	4.94
10	27	3.92	5.27
11	30	4.08	5.22
12	33	4.18	5.67

From above table shows the Storey Displacement Values in Transverses (Z) Direction in ZONE-III of G+10 Storey building.

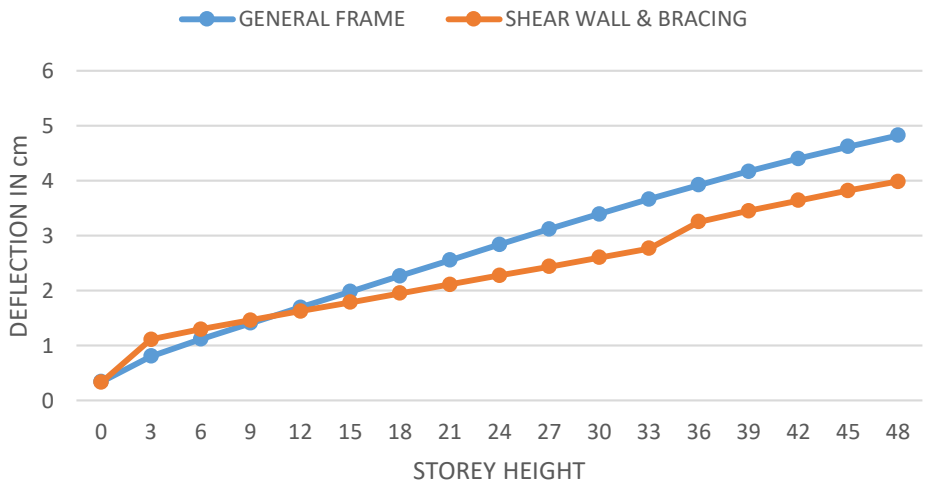


GRAPH 5: COMPARISION BETWEEN GENERAL FRAME, SHEAR WALL & BRACING OF C-SHAPED FRAME IN ZONE III (G+10)

Table 6 The results of General frame of C-shape & C shape with Shear wall and bracing frame

S.No	Storey Height	Lateral displacement in cm	
		General frame of C-shape	C shape with Shear wall and bracing frame
1	0	1.79	1.15
2	3	3.85	1.36
3	6	4.74	1.55
4	9	5.54	1.75
5	12	6.43	1.94
6	15	7.14	2.14
7	18	7.91	2.35
8	21	8.67	2.56
9	24	9.41	2.83
10	27	10.10	3.69
11	30	10.75	3.99
12	33	11.35	4.28
13	36	11.88	4.54
14	39	12.33	4.78
15	42	12.68	4.99
16	45	12.94	5.15
17	48	13.08	5.27

From above table shows the Storey Displacement Values in Transverses (Z) Direction in ZONE-III of G+15 Storey building.



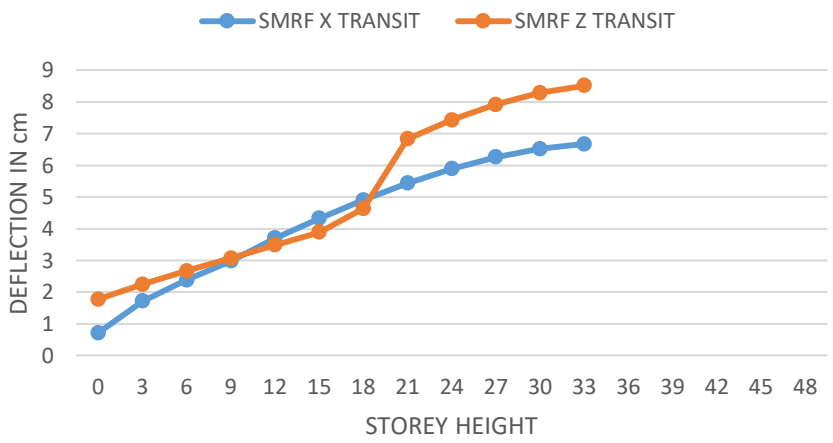
GRAPH 6 : COMPARISION BETWEEN GENERAL FRAME, SHEAR WALL & BRACING OF C-SHAPED FRAME IN ZONE III (G+15)

ZONE IV

Table 7 The results of General frame of C-shape & C shape with Shear wall and bracing frame

S.No	Storey Height	Lateral displacement in cm	
		General frame of C-shape	C shape with Shear wall and bracing frame
1	0	0.72	1.77
2	3	1.71	2.24
3	6	2.38	2.66
4	9	2.97	3.07
5	12	3.70	3.48
6	15	4.32	3.88
7	18	4.90	4.63
8	21	5.43	6.82
9	24	5.89	7.42
10	27	6.25	7.91
11	30	6.51	8.28
12	33	6.6664	8.5103

From above table shows the Storey Displacement Values in Transverses (Z) Direction in ZONE-IV of G+10 Storey building.

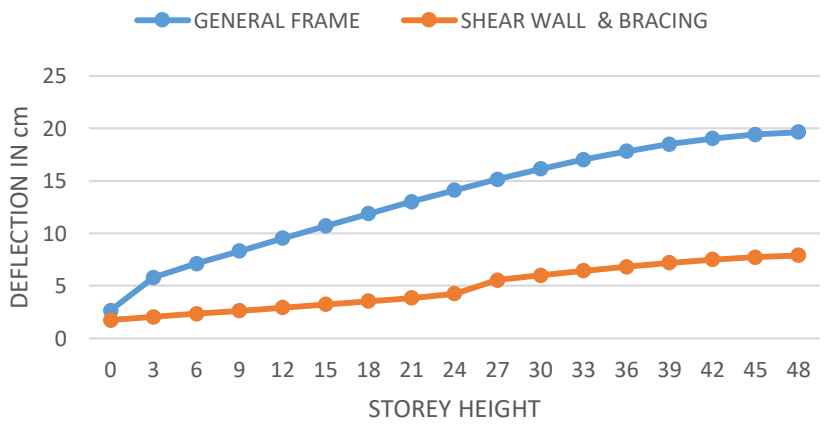


GRAPH 7: COMPARISION BETWEEN GENERAL FRAME, SHEAR WALL & BRACING OF C-SHAPED FRAME IN ZONE IV (G+10)

Table 8 The results of General frame of C-shape & C shape with Shear wall and bracing frame

S.No	Storey Height	Lateral displacement in cm	
		General frame of C-shape	C shape with Shear wall and bracing frame
1	0	2.69	1.72
2	3	5.78	2.05
3	6	7.11	2.33
4	9	8.32	2.62
5	12	9.52	2.92
6	15	10.71	3.22
7	18	11.87	3.53
8	21	13.01	3.84
9	24	14.11	4.25
10	27	15.15	5.53
11	30	16.13	5.99
12	33	17.02	6.42
13	36	17.82	6.82
14	39	18.49	7.18
15	42	19.03	7.49
16	45	19.41	7.73
17	48	19.63	7.90

From above table shows the Storey Displacement Values in Transverses (Z) Direction in ZONE-IV of G+15 Storey building.



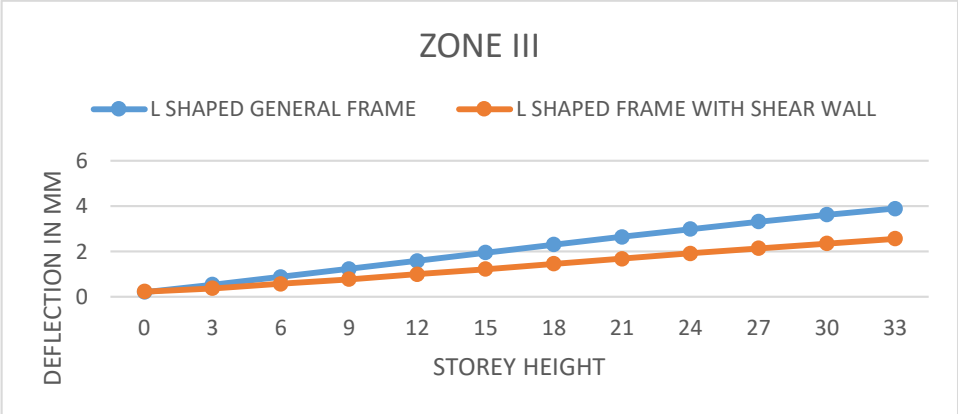
GRAPH 8: COMPARISION BETWEEN GENERAL FRAME, SHEAR WALL & BRACING IN ZONE IV (G+15)

ZONE III

Table 9 The results of General frame of L-shape & L shape with Shear wall and bracing frame

S,NO	STOREY HEIGHT	L SHAPED GENERAL FRAME	L SHAPED FRAME WITH SHEAR WALL
1	0	0.20	0.22
2	3	0.53	0.37
3	6	0.87	0.56
4	9	1.22	0.77
5	12	1.58	0.99
6	15	1.94	1.22
7	18	2.29	1.45
8	21	2.64	1.68
9	24	2.98	1.91
10	27	3.31	2.13
11	30	3.61	2.35
12	33	3.89	2.56

From above table shows the lateral Displacement Values in Transverses (X) Direction of L- SHAPED FRAME in ZONE-III of G+10.

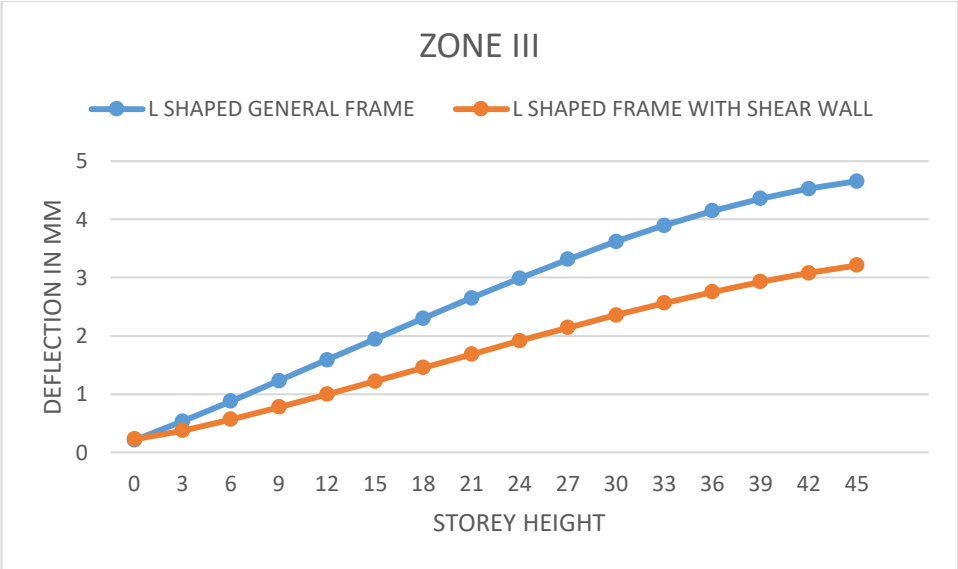


GRAPH 9: COMPARISION BETWEEN GENERAL FRAME, SHEAR WALL & BRACING OF L-SHAPED STRUCTURE IN ZONE III (G+10)

Table 10 The results of General frame of L-shape & L shape with Shear wall and bracing frame

S.NO	STOREY HEIGHT	L SHAPED GENERAL FRAME	L SHAPED FRAME WITH SHEAR WALL
1	0	0.20	0.22
2	3	0.53	0.37
3	6	0.87	0.56
4	9	1.22	0.77
5	12	1.58	0.99
6	15	1.94	1.22
7	18	2.29	1.45
8	21	2.64	1.68
9	24	2.98	1.91
10	27	3.31	2.13
11	30	3.61	2.35
12	33	3.89	2.56
13	36	4.14	2.75
14	39	4.35	2.92
15	42	4.52	3.07
16	45	4.65	3.21

From above table shows the Storey Displacement Values in Transverses (X) Direction of V- SHAPED FRAME in ZONE-III of G+15 Storey building.



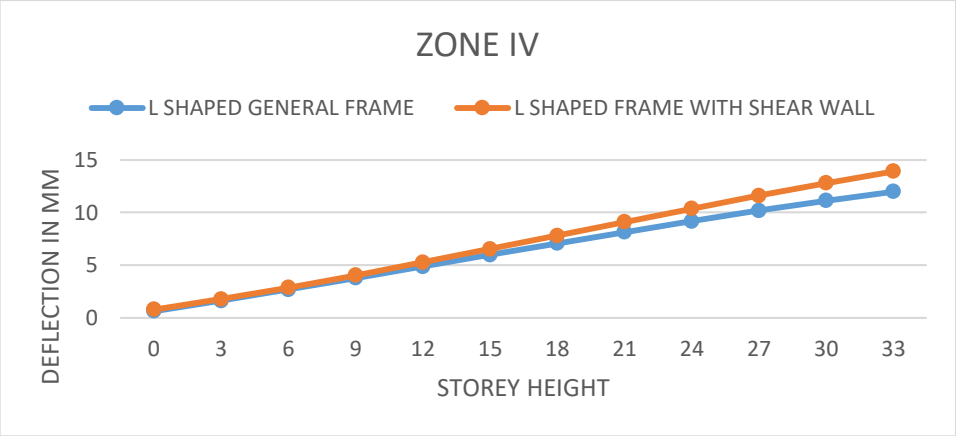
GRAPH 10: COMPARISION BETWEEN GENERAL FRAME, SHEAR WALL & BRACING OF L-SHAPED STRUCTURE IN ZONE III (G+15)

ZONE IV

Table 11 The results of General frame of L-shape & Lshape with Shear wall and bracing frame

S.NO	STOREY HEIGHT	L SHAPED GENERAL FRAME	L SHAPED FRAME WITH SHEAR WALL
1	0	0.64	0.78
2	3	1.63	1.77
3	6	2.69	2.87
4	9	3.77	4.04
5	12	4.87	5.27
6	15	5.97	6.53
7	18	7.06	7.81
8	21	8.14	9.10
9	24	9.18	10.37
10	27	10.18	11.60
11	30	11.11	12.79
12	33	11.97	13.92

From above table shows the Storey Displacement Values in Transverses (X) Direction in ZONE-IV of G+10 Storey building

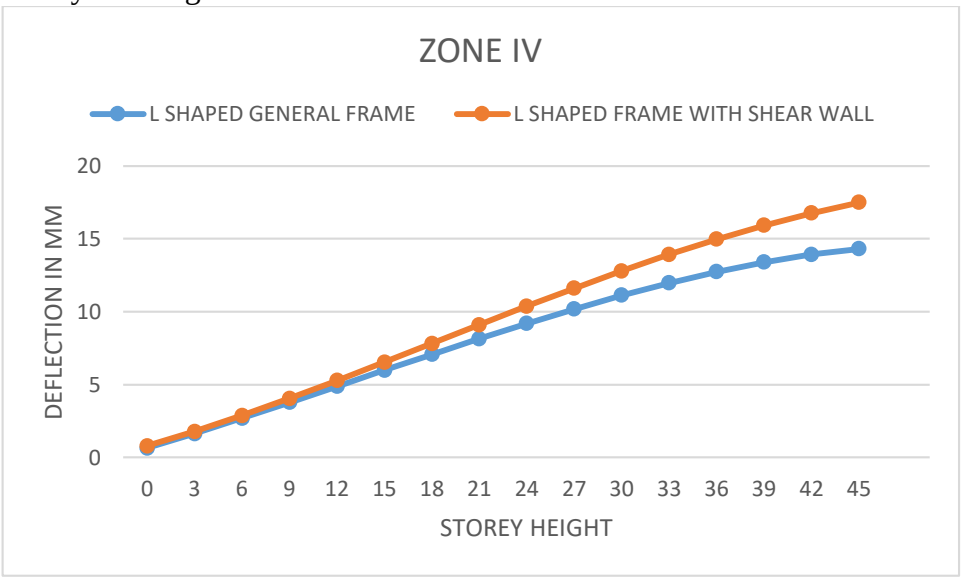


GRAPH 11: COMPARISION BETWEEN GENERAL FRAME, SHEAR WALL & BRACING OF L-SHAPED STRUCTURE IN ZONE IV (G+10)

Table 12 The results of General frame of L-shape & L shape with Shear wall and bracing frame

S.NO	STOREY HEIGHT	L SHAPED GENERAL FRAME	L SHAPED FRAME WITH SHEAR WALL
1	0	0.64	0.78
2	3	1.63	1.77
3	6	2.69	2.87
4	9	3.77	4.04
5	12	4.87	5.27
6	15	5.97	6.53
7	18	7.06	7.81
8	21	8.14	9.10
9	24	9.18	10.37
10	27	10.18	11.60
11	30	11.11	12.79
12	33	11.97	13.92
13	36	12.74	14.96
14	39	13.39	15.91
15	42	13.92	16.75
	45	14.31	17.48

From above table shows the Storey Displacement Values in Transverses (X) Direction in ZONE-IV of G+15 Storey building.



GRAPH 12 : COMPARISION BETWEEN GENERAL FRAME, SHEAR WALL & BRACING OF V-SHAPED STRUCTURE IN ZONE IV (G+15

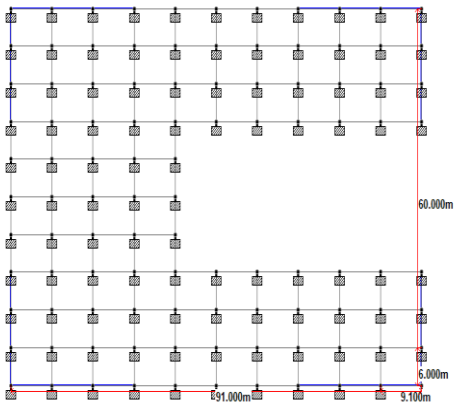


Fig 1 **FLOOR PLAN OF C- SHAPED STRUCTURE**

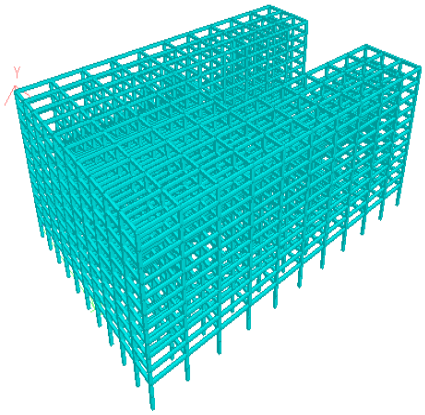


Fig: 2 G+10 GENERAL FRAME of C SHAPED STRUCTURE

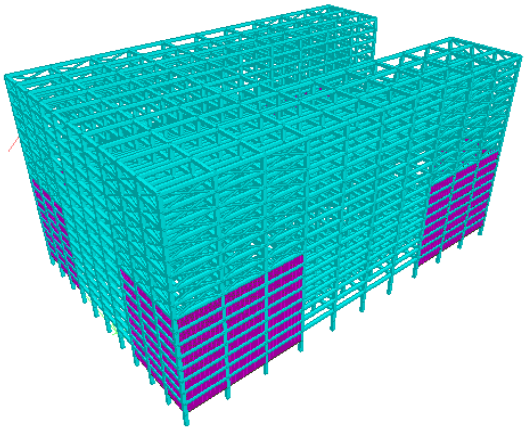


Fig 3: G+10 SHEAR WALL& BRACING AT CORNER

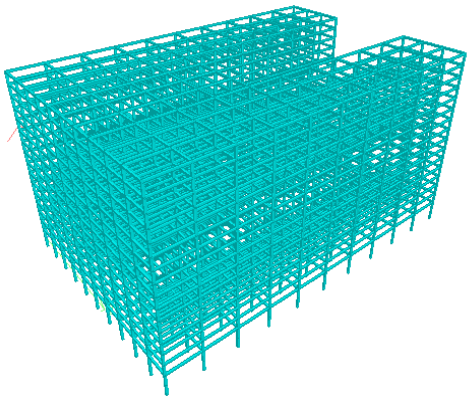


Fig: 4 G+15 GENERAL FRAME

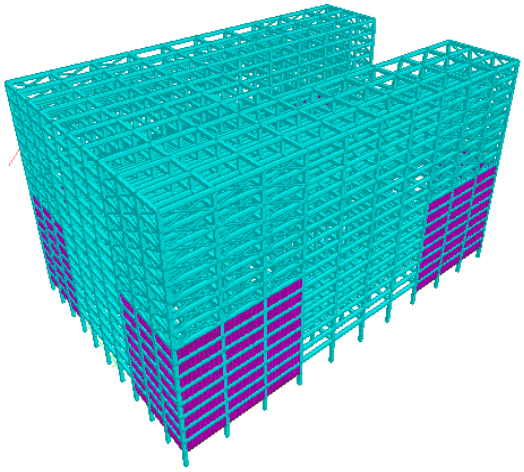


Fig 5 G+15 SHEAR WALL & BRACING AT CORNER

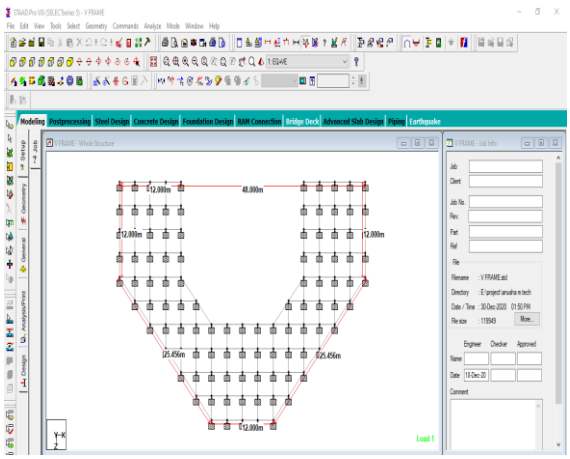


Fig 6 FLOOR PLAN OF V- SHAPED STRUCTURE

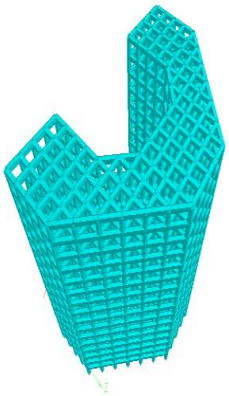


Fig: 7 G+10 GENERAL FRAME OF V SHAPE

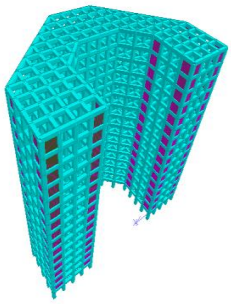


Fig 8: G+10 SHEAR WALL& BRACING AT CORNER

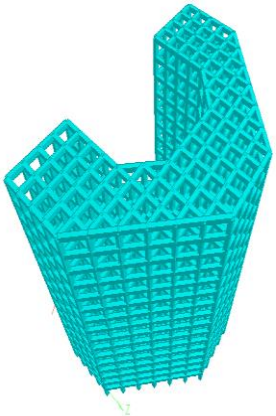


Fig: 9 G+15 GENERAL FRAME

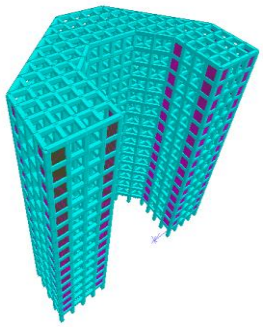


Fig 10 G+15 SHEAR WALL & BRACING AT CORNER

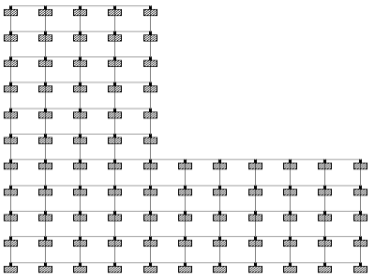


Fig 11 **FLOOR PLAN OF L- SHAPED STRUCTURE**

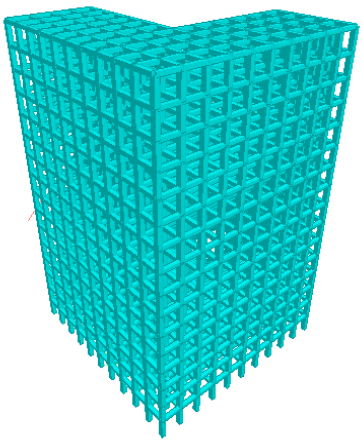


Fig: 12 G+10 GENERAL FRAME of L SHAPED STRUCTURE

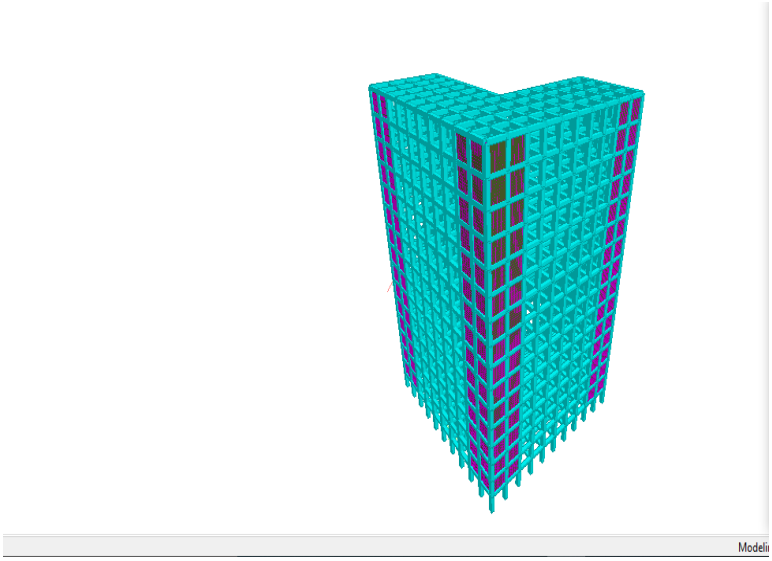


Fig 13: G+10 SHEAR WALL& BRACING AT CORNER

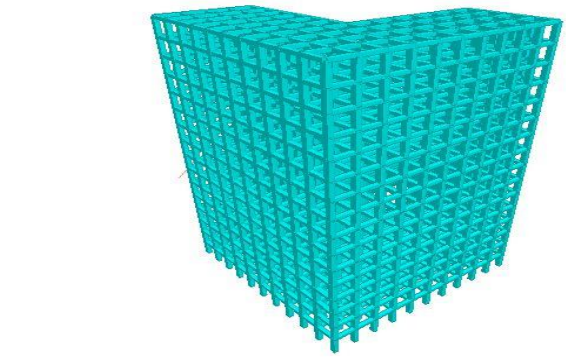


Fig: 14 G+15 GENERAL FRAME

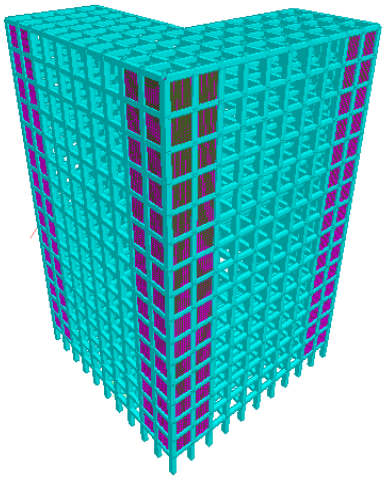


Fig 15 G+15 SHEAR WALL & BRACING AT CORNER

5. CONCLUSION

COMPARISION OF V- SHAPED FRAME OF G+10 & G+15 STOREY BUILDING FOR VARIOUS SEISMIC ZONES.

ZONE III

- when coming to G+10 storey building the variation of storey drift between without shear wall and bracings and with Shear wall & bracing structure 0.51%
- when coming to G+15 Storey building the variation of Storey drift between without shear wall and bracings and with Shear wall & bracing structure 0.44%

ZONE IV

- when coming to G+10 storey building the variation of storey drift between G without shear wall and bracings and with Shear wall & bracing structure 5.41%
- when coming to G+15 Storey building the variation of Storey drift between without shear wall and bracings and with Shear wall & bracing structure 6.49%

COMPARISION OF C- SHAPED FRAME OF G+10 & G+15 STOREY BUILDING FOR VARIOUS SEISMIC ZONES.

ZONE III

- when coming to G+10 storey building the variation of storey drift between without shear wall and bracings and with Shear wall & bracing structure 1.49%
- when coming to G+15 Storey building the variation of Storey drift between without shear wall and bracings and with Shear wall & bracing structure 7.81%

ZONE IV

- when coming to G+10 storey building the variation of storey drift between G without shear wall and bracings and with Shear wall & bracing structure 1.85%
- when coming to G+15 Storey building the variation of Storey drift between without shear wall and bracings and with Shear wall & bracing structure 11.76%

COMPARISION OF L- SHAPED FRAME AND I SHAPED FRAME OF G+10 & G+15 STOREY BUILDING FOR VARIOUS SEISMIC ZONES.

ZONE III

- when coming to G+10 storey of L- Shaped building frame the variation of storey drift between without shear wall and bracings and with Shear wall & bracing structure 1.33%
- when coming to G+15 Storey building the variation of Storey drift between without shear wall and bracings and with Shear wall & bracing of L shaped structure 1.44%

ZONE IV

- when coming to G+10 storey of L- Shaped building frame the variation of storey drift between without shear wall and bracings and with Shear wall & bracing structure 1.95%
- when coming to G+15 Storey building the variation of Storey drift between without shear wall and bracings and with Shear wall & bracing of L shaped structure 3.17%

When compared to zone III, IV the lateral displacement is less in zone IV for V-shaped frame.

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