A Study On Seismic Performance of RC Structures Using Different Bracing Systems

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Abstract – Concrete braced frame is one of the structural system used to resist earthquake loads in multistoried buildings. In high rise buildings it is very important to ensure adequate lateral stiffness to resist lateral force. Bracing systems are one of the excellent means of providing earthquake resistance to multistoreyed reinforced concrete building. Concrete bracing is economical , easy to erect, occupies less space and has flexibility to design for meeting the required strength and stiffness. In the present study the analysis is to be carried on multistoreyed buildings of G+14 storey , G+24 storey and G+34 storey with different configurations of concrete bracings such as X-brace, V-brace, Chevron brace and Eccentric brace. Top displacement is studied in all types of buildings with braces and in various seismic zones of India and in different soil types taken as Type-I, Type-II and Type-III. As per IS 1893(Part I): 2002 using SAP2000 16 software. The effectiveness of various types of Concrete bracing in all buildings is examined. The effect of the distribution of the steel bracing along the height of the RC frame on the seismic performance of the rehabilitated buildings is studied. The performance of the building is evaluated in terms of Lateral displacement, Interstorey drift and Base shear. The percentage reduction in lateral displacement is found.

Keywords: X-Brace, V-Brace, Inverted V Brace, Eccentric Brace, Top Lateral Displacement, Storey Drift, Base Shear, Seismic Zones(II,III,IV&V), Soil Types(I,II&III).

I. INTRODUCTION

Behaviour of structure during an earthquake motion depends on distribution of weight, stiffness and strength in both horizontal and vertical planes of building. Structural design of buildings for seismic loading is primarily concerned with structural safety during major earthquake. In High rise buildings, it is very important to ensure adequate lateral stiffness to resist lateral force. Bracing systems are one of the excellent means of providing earthquake resistance to multistoreyed reinforced concrete building. These can be used for improving seismic response of buildings. When Bracing systems are situated in advantageous position they can form an efficient lateral force resisting system. In the present work an analysis has to be carried on multistoreyed buildings of 15 storeys , 25 storeys and 35 stories with bare frame and also with different configurations of concrete bracings such as X-brace , V-brace, chevron brace and Eccentric brace. Top displacement is studied in all types of buildings with braces and in various seismic zones of india and in different soil types as well. So, we can understand the variation of lateral displacements in buildings. Results obtained from the analysis are lateral displacement, base shear and interstorey drift. The results are shown for static and dynamic analysis using Equivalent static method and Response Spectrum method. The parameters of investigation are types of soil , zone factors, Height of the buildings and Bracing systems. The top floor displacements for different heights(15,25,35) of buildings is investigated and collected, considering seismic zones II, III, IV, V and with respect to all soil types (I, II, III) and for different types of lateral load resisting systems (bracings) with reference to different loading conditions Similarly the top floor displacement for different building models is collected considering stories with respect to zone 5 and soil type III with respect to different loading conditions.

II. STRUCTURAL CONCEPTS

The key idea in conceptualizing the structural system for a narrow tall building is to think of it as a beam cantilevering from the earth. The laterally erected force generated, either due to wind blowing against the building or due to the inertia forces induced by ground shaking, tends both to snap it (shear) and push it over (bending). Therefore, the building must have a system to resist shear as well as bending. In resisting shear forces, the building must not break by shearing off, and must not strain beyond the limit of elastic recovery. Similarly, the system resisting the bending must satisfy three needs.

1. The building must not overturn from the combined forces of gravity and lateral loads due to wind or seismic effects.

2. It must not break by premature failure of columns either by crushing or by excessive tensile forces

3. Its bending deflection should not exceed the limit of elastic recovery.

III. BUILDING DIMENSIONS

The building which has to be analysed have 48m x 48m plan with colums spaced at6m from center to center. A floor to floor height of 3.0m is assumed. The location of the building is assumed to be at different seismic zones with different types of soils.

IV. PLAN AND ELEVATION OF MODEL

The descriptions of the proposed structural model No.1 are as given below.

Type of Structure -Multi-storied rigid frame
Seismic Zone -Zones II, III, IV & V
No. of Stories -15
Floor height -3 m
Self weight of the Structure -25 KN/ m3
Live load -3KN/ m3
Depth of Slab -120mm
Column Size -650x650
Beam Size -350x450
Thickness of Outer wall -230mm
Thickness of Inner wall -115mm
Grade of Concrete -M30
Grade of Reinforcement -Fe415
Specific weight of RCC -25 KN/ m3
Specific weight of Brick -20 KN/ m3
Type of soil -I, II and III
Equivalent static analysis -As per I.S 1893 (part I): 2002.
Response Spectrum -As per I.S 1893 (part I): 2002.
Young's Modulus -5000 = 5000√40 = 31622 fck .

A simple plan of 48m x 48m is taken with 8 bays of 6 m each as shown below is adopted to determine the effects of lateral systems in the building models.

V. CASE STUDY

Top Lateral Displacement

CASE-I : 15 Storey Building .

The description of the proposed structural model No.1 is as given below.

1) Type of Structure -Multi-storied rigid frame
2) Seismic Zone -Zones II,III,IV & V
3) No. of Stories -15
4) Floor height -3 m
5) Self weight of the Structure -25 KN/ m3
6) Live load -3KN/ m3
7) Dead load -4KN/m3
8) Depth of Slab -120mm
9) Column Size -650 x 650
10) Beam Size -350 x 450
11) Brace Size -230 x 230
12) Thickness of Outer wall -230mm
13) Thickness of Inner wall -115mm
14) Grade of Concrete -M30
15) Grade of Reinforcement -Fe415
16) Specific weight of RCC -25 KN/ m3
17) Specific weight of Brick -20 KN/ m3
18) Type of soil -I,II and III
19) Equivalent static analysis -As per I.S 1893 (part I): 2002.
20) Response Spectrum -As per I.S 1893 (part I): 2002

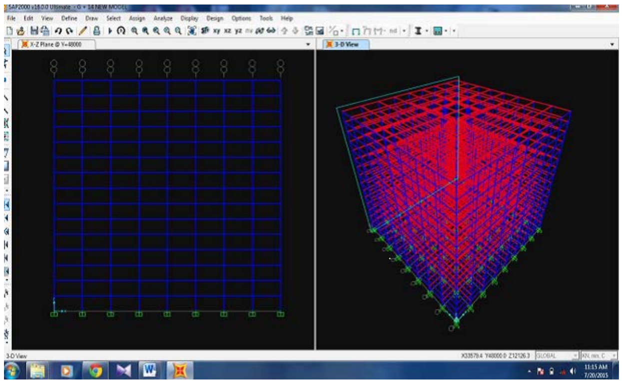

Fig: 5.1: Screen capture of modelling G + 14 Structure in SAP2000 16.

Lateral Displacement of different types of systems for all seismic zones and all soil types

Table 5.1: Showing Lateral Displacements with respect to all Seismic Zones Soil Type III and loading Static –15 Storey model.

SEISMIC ZONES	LATERAL DISPLACEMENT (mm)				
	WITHOUT BRACE	X-BRACE	V-BRACE	INVERTED-V BRACE	ECCENTRIC BRACE
ZONE II	12	8.63	8.77	8.53	7.88
ZONE III	17	13.78	13.99	13.74	12.61
ZONE IV	25.5	20.67	20.98	20.61	18.92
ZONE V	38.3	31.01	31.47	30.91	28.38
ALL UNITS ARE IN MILLIMETRE					

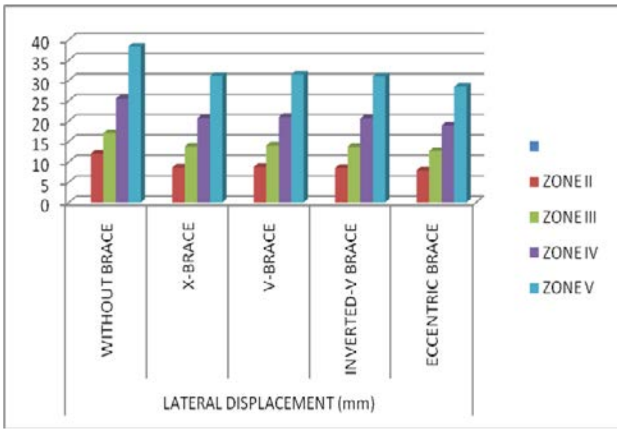

Fig5.2: Seismic zones Vs Max Displacement of different systems for 15 stories with static load and soil type III.

Table 5.3: Showing Lateral Displacements with respect to all Seismic Zones Soil Type II and loading Static –15 Storey model.

SEISMIC ZONES	LATERAL DISPLACEMENT (mm)				
	WITHOUT BRACE	X-BRACE	V-BRACE	INVERTED-V BRACE	ECCENTRIC BRACE
ZONE II	14.3	10.12	11.66	10.72	11.68
ZONE III	23.1	16.2	18.68	17.15	14.65
ZONE IV	34.7	24.3	28.03	25.73	18.92
ZONE V	52.1	36.45	42.04	27.4	38.68
ALL UNITS ARE IN MILLIMETRE					

CASE-2*: 25 Storey Building*

The description of the proposed structural model No.2 is as given below.

Type of Structure -Multi-storied rigid frame
Seismic Zone -Zones II,III,IV & V
No. of Stories -25
Floor height -3 m
Self weight of the Structure -25 KN/ m3
Live load -3KN/ m3
Dead load -4KN/m3
Depth of Slab -120mm
Column Size -650 x 650
Beam Size -400 x 450
Brace Size -230 x 230
Thickness of Outer wall -230mm
Thickness of Inner wall -115mm
Grade of Concrete -M40
Grade of Reinforcement -Fe415
Specific weight of RCC -25 KN/ m3
Specific weight of Brick -20 KN/ m3
Type of soil - I,II and III
Equivalent static analysis - As per I.S 1893 (part I): 2002.
Response Spectrum - As per I.S 1893 (part I): 2002.

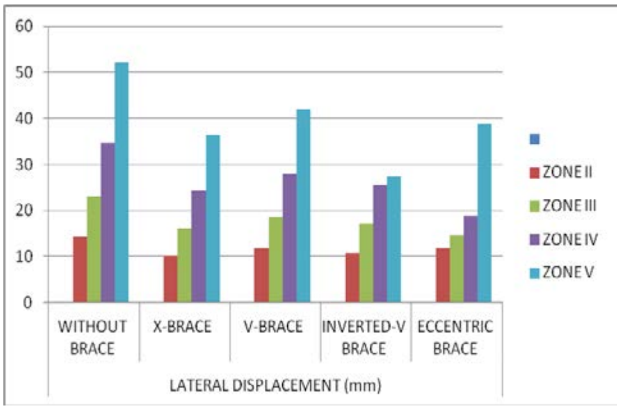

Fig5.4: Seismic zones Vs Max Displacement of different systems for 15 stories with static load and soil type II

Table 5.5: Showing Lateral Displacements with respect to all Seismic Zones Soil Type II and loading Static –15 Storey model.

SEISMIC ZONES	LATERAL DISPLACEMENT (mm)				
	WITHOUT BRACE	X-BRACE	V-BRACE	INVERTED-V BRACE	ECCENTRIC BRACE
ZONE II	12	8.63	8.77	8.58	7.88
ZONE III	17	13.78	13.99	13.74	12.61
ZONE IV	25.5	20.67	20.98	20.61	18.92
ZONE V	38.3	31.01	31.47	30.91	28.38
ALL UNITS ARE IN MILLIMETRE					

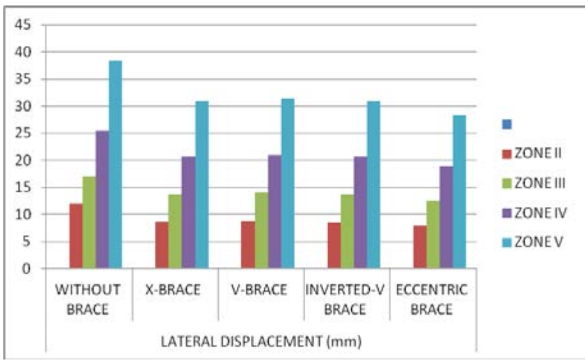

Fig5.6: Seismic zones Vs Max Displacement of different systems for 15 stories with static load and soil type I.

Young's Modulus - 5000*fck*= 5000√40 = 31622

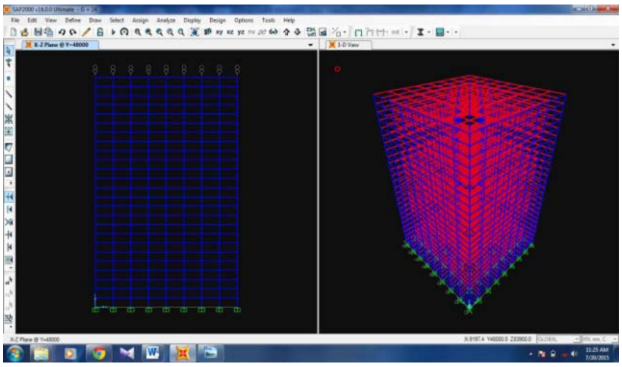

Fig: 5.8: Screen capture of modelling G + 24 Structure in SAP2000 16

Discussions of Result for three case of Displacement of various bracimgs in all zones and soil types for all storey building.

In this present case the different type of bracing systems is compared individually to check the performance of each system under different seismic zones and keeping the soil type constant. Seismic zones are taken on x-axis and the lateral displacements are taken on Y-axis. The graphs were plotted for different types of loading conditions. It was observed that the roof displacements for 15,25 and 35 storey buildings the displacements increases with increase in zone factor for both static and dynamic loads. For 15 storey building model the variation of displacement is about 35% for zone Z2 to Z3 and about 33% from Z3 to Z4 and about 30% from Z4 to Z5, for 25 storey model the increment in the value of lateral displacement is about 38%, 34%, 33% for Z2-Z3, Z3-Z4, Z4-Z5. In 35 storey model the variation quite the the same. This results gives us an idea that the displacements in the zone factor increases linearly. This is true for dynamic loading case as well.

Table 5.7: Showing Lateral displacements with respect to all soil types, Loading static 25 storey model.

SEISMIC ZONES	LATERAL DISPLACEMENT (mm)				
	WITHOUT BRACE	X-BRACE	V-BRACE	INVERTED-V BRACE	ECCENTRIC BRACE
ZONE II	25.59	18.46	18.54	18	23.5
ZONE III	40.95	29.46	29.67	29.27	37.6
ZONE IV	61.43	44.19	44.5	43.91	56.5
ZONE V	92.15	66.29	66.75	65.81	84.7
ALL UNITS ARE IN MILLIMETRE					

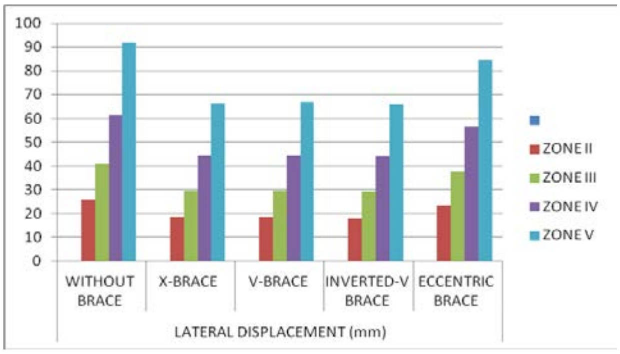

Fig5.8: Seismic zones Vs Max Displacement of different systems for 25 stories with static load and soil type III

Table 5.8 :Showing Lateral displacements with respect to all soil types, Loading static 25 storey model.

SEISMIC ZONES	LATERAL DISPLACEMENT (mm)				
	WITHOUT BRACE	X-BRACE	V-BRACE	INVERTED-V BRACE	ECCENTRIC BRACE
ZONE II	20.83	15.93	15.01	17.49	23.5
ZONE III	33.32	25.24	24.16	27.99	37.6
ZONE IV	50.03	35.01	36.24	42.91	56.5
ZONE V	70.03	53.54	54.36	62.99	84.7
ALL UNITS ARE IN MILLIMETRE					

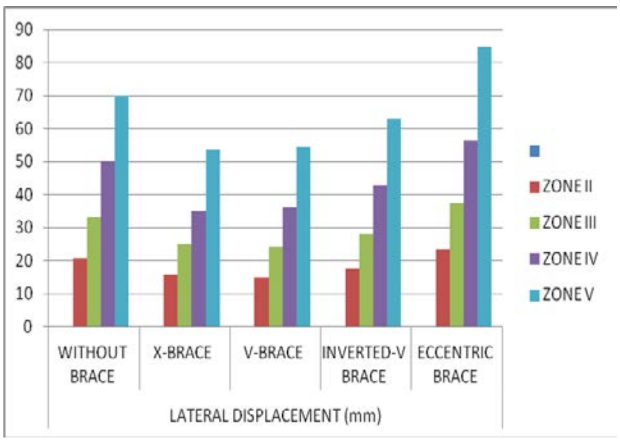

Fig 5.9: Seismic zones Vs Max Displacement of different systems for 25 stories with static load and soil type II

Table 5.10: Showing Lateral displacements with respect to all soil types, Loading static 25 storey model.

SEISMIC ZONES	LATERAL DISPLACEMENT (mm)				
	WITHOUT BRACE	X-BRACE	V-BRACE	INVERTED-V BRACE	ECCENTRIC BRACE
ZONE II	15.32	11.03	11.10	10.95	14.10
ZONE III	24.52	17.64	17.76	17.52	22.56
ZONE IV	36.78	26.46	36.67	26.26	33.84
ZONE V	55.18	39.69	39.97	39.45	50.76
ALL UNITS ARE IN MILLIMETRE					

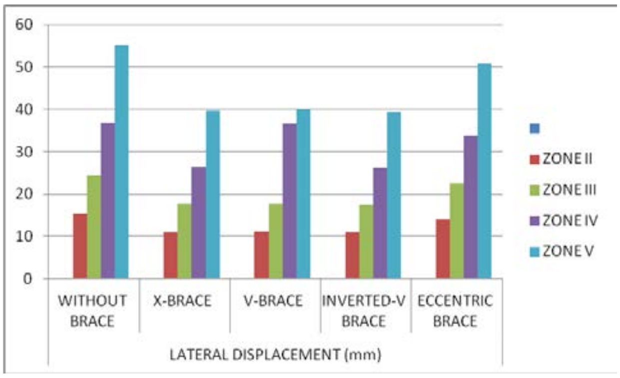

Fig5.11: Seismic zones Vs Max Displacement of different systems for 25 stories with static load and soil type I

CASE-3: *35 Storey Building*

The description of the proposed structural model No.3are as given below.

Type of Structure -Multi-storied rigid frame

Seismic Zone -Zones II,III,IV & V

No. of Stories -35

Floor height -3 m

Self weight of the Structure -25 KN/ m3

Live load -3KN/ m3

Dead load -4KN/m3

Depth of Slab -120mm

Column Size -800 x 800

Beam Size -500 x 500

Brace Size -250 x 250

Thickness of Outer wall -230mm

Thickness of Inner wall -115mm

Grade of Concrete -M40

Grade of Reinforcement -Fe415

Specific weight of RCC -25 KN/ m3

Specific weight of Brick -20 KN/ m3

Type of soil - I,II and III

Equivalent static analysis - As per I.S 1893 (part I): 2002.

Response Spectrum - As per I.S 1893 (part I): 2002.

Modulus of elasticity - 5000*fck*= 5000√40 = 31622

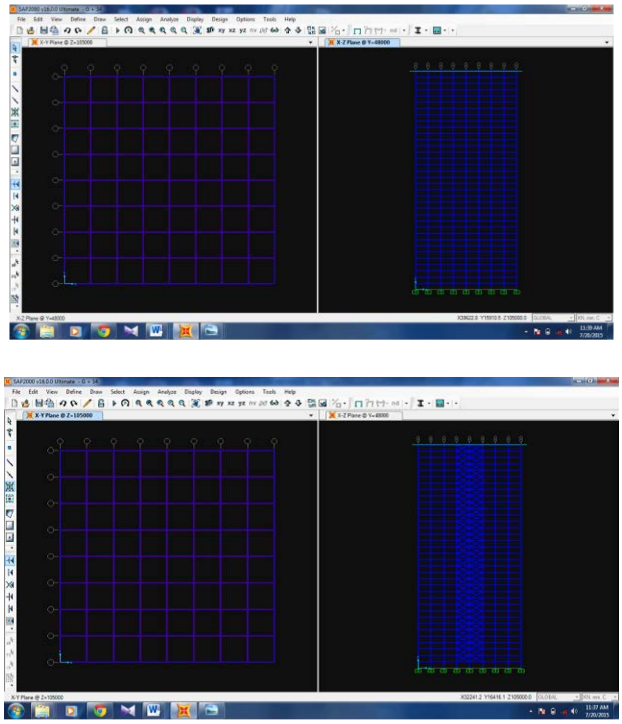

Fig: 5.12: Screen capture of modelling G + 34 Structure in SAP2000 16.

Table 5.13: Showing Lateral displacements with respect to all soil types, Loading static 35 storey model

SEISMIC ZONES	LATERAL DISPLACEMENT (mm)				
	WITHOUT BRACE	X-BRACE	V-BRACE	INVERTED-V BRACE	ECCENTRIC BRACE
ZONE	30.24	23.01	27.67	23.5	28.69

II					
ZONE III	48.39	36.82	44.28	36.83	45.90
ZONE IV	72.58	55.23	66.42	55.24	68.86
ZONE V	108.87	82.58	99.63	82.86	130.96
ALL UNITS ARE IN MILLIMETRE					

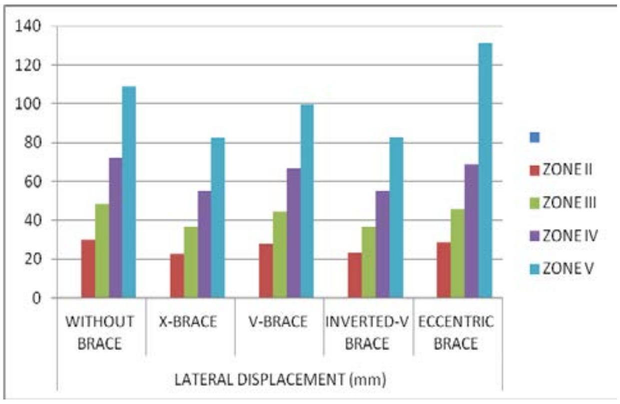

Fig5.14: Seismic zones Vs Max Displacement of different systems for 35 stories with static load and soil type III.

Table 5.15: Showing Lateral displacements with respect to all soil types, Loading Static 35 storey model.

SEISMIC ZONES	LATERAL DISPLACEMENT (mm)				
	WITHOUT BRACE	X-BRACE	V-BRACE	INVERTED-V BRACE	ECCENTRIC BRACE
ZONE II	24.63	18.7	22.5	18.74	18.22
ZONE III	39.4	29.98	36	29.99	29.1
ZONE IV	59.11	44.98	56	44.9	43.7
ZONE V	88.67	67.5	82	67.4	65.6
ALL UNITS ARE IN MILLIMETRE					

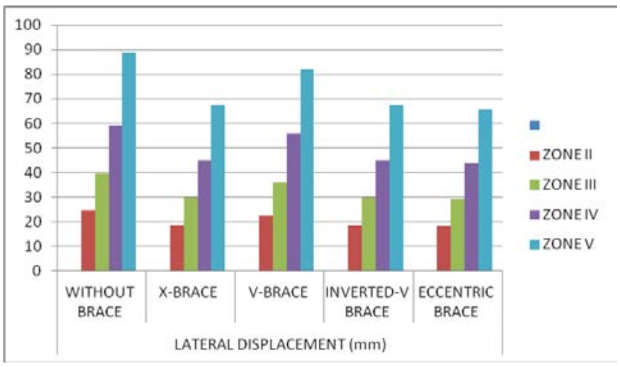

Fig5.16: Seismic zones Vs Max Displacement of different systems for 35 stories with static load and soil type II.

Table 5.17 : Showing Lateral Displacement with soil types , loading static 35 storey model.

SEISMIC ZONES	LATERAL DISPLACEMENT (mm)				
	WITHOUT BRACE	X-BRACE	V-BRACE	INVERTED-V BRACE	ECCENTRIC BRACE
ZONE II	18.11	13.78	16.57	13.78	17.18
ZONE III	28.97	22.04	26.51	22.05	27.48
ZONE IV	43.46	33.07	39.77	33.08	41.23
ZONE V	65.19	49.61	59.66	49.62	61.85
ALL UNITS ARE IN MILLIMETRE					

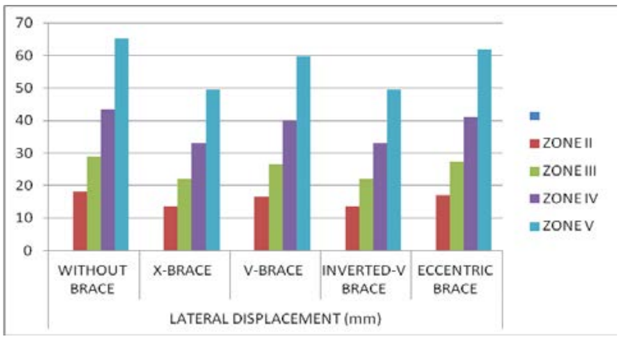

Fig5.18: Seismic zones Vs Max Displacement of different systems for 35 stories with static load and soil type I

Discussions of Result for three case of Displacement of various bracimgs in all zones and soil types for all storey building.

In this present case the different type of bracing systems is compared individually to check the performance of each system under different seismic zones and keeping the soil type constant. Seismic zones are taken on x-axis and the lateral displacements are taken on Y-axis. The graphs were plotted for different types of loading conditions. It was observed that the roof displacements for 15,25 and 35 storey buildings the displacements increases with increase in zone factor for both static and dynamic loads. For 15 storey building model the variation of displacement is about 35% for zone Z2 to Z3 and about 33% from Z3 to Z4 and about 30% from Z4 to Z5, for 25 storey model the increment in the value of lateral displacement is about 38%, 34%, 33% for Z2-Z3, Z3-Z4, Z4-Z5. In 35 storey model the variation quite the the same. This results gives us an idea that the displacements in the zone factor increases linearly. This is true for dynamic loading case as well.

Lateral Drifts With Respect To Each Storey Of 15 Storied Building

Storey	Lateral Drift				
	Without brace	X-Brace	V-Brace	Inv V Brace	Eccentric Brace
0	0	0	0	0	0
1	4.2	4.6	4.9	5.3	5.6
2	4.4	2.8	3	3.3	2.7
3	5.1	3.3	3.3	5.3	3.1
4	6.9	4.7	5.5	2.5	4
5	4.7	3.5	3	4.4	3.1
6	3.4	5.6	6.2	3.5	5.1
7	2.8	3.9	3.8	5.2	7.6
8	2.7	4.4	4.2	7.3	2.4
9	3.9	3.6	3.8	1.4	1.6
10	6.3	3.1	4	2.7	2.3
11	3.7	1.8	0.8	1.8	2.3
12	4.5	3.2	3.3	2.1	1.7
13	4.7	2.9	3.1	2.8	2.3
14	4.1	2.5	1.2	2.2	1.2
15	2.5	1.8	2.5	1.83	2.4

Lateral Drifts With Respect To Each Storey Of 25 Storied Building

Storey	Lateral Drift				
	Without brace	X-Brace	V-Brace	Inv V Brace	Eccentric Brace
0	0	0	0	0	0
1	6.2	6.6	9.5	3.6	5.2
2	4.4	2.8	2.9	0.9	3.2
3	5.1	3.3	3.1	3.1	3.1
4	7.9	3.7	3.4	2.1	2.6
5	2.7	3.5	2.2	1.4	3.3
6	3.4	5.6	4.5	1.7	3.4
7	1.8	3.9	4.1	1.7	4.4
8	6.7	4.4	2.2	2.2	3.3
9	3.9	1.6	2.9	2.1	2.4
10	4.3	3.1	1.8	4.5	4.4
11	2.7	1.8	3.2	4.3	3.2
12	4.5	1.2	2.9	3.2	2.4
13	2.7	1.9	2.1	2.3	4.3
14	3.1	2.5	1.9	3.4	4.7
15	3.5	1.5	2.2	1.7	4.5
16	2.8	1.1	2.9	2.7	4.1
17	2.9	2.1	2.6	1.8	2.4
18	2.6	1.9	2.4	11.7	4.6
19	3.2	1.6	0.9	2.9	2.5
20	3.5	2.3	1.1	2.5	4
21	1.9	1.7	2.9	1.1	3.5
22	2.8	1.6	0.5	2.9	3.4
23	2.8	2.2	1.2	1.6	2.2
24	3.8	2.6	0.9	1.8	2.3
25	2.9	2.1	2.4	3.6	3.5

Lateral Drifts With Respect To Each Storey Of 35 Storied Building

Storey	Lateral Drift				
	Without brace	X-Brace	V-Brace	Inv V Brace	Eccentric Brace
0	0	0	0	0	0
1	6.2	6.6	9.5	3.6	5.2
2	4.4	2.8	2.9	0.9	3.5
3	5.1	3.3	3.1	3.1	3.1
4	7.9	3.7	3.4	2.1	2.6
5	2.7	3.5	2.2	1.4	3.3
6	3.4	5.6	4.5	1.7	3.4
7	1.8	3.9	4.1	1.7	4.4
8	6.7	4.4	2.2	3.2	3.2
9	3.9	1.6	2.9	2.1	2.4
10	4.3	3.1	1.8	2.5	4.1
11	10.2	7.6	8.5	3.6	6.2
12	8.4	2.8	4.5	2.9	5.5
13	7.1	3.3	4.1	4.1	4.1
14	6.9	3.7	3.4	5.1	4.6
15	3.4	3.5	2.2	3.4	4.3
16	4.4	5.6	4.5	4.7	3.4
17	3.8	3.9	4.1	3.7	4.4
18	3.7	4.4	2.2	4.2	4.2
19	3.9	1.6	2.9	4.1	3.4
20	5.3	3.1	0.8	3.5	5.3
21	3.7	1.8	5.2	6.1	2.7
22	4.5	1.2	2.9	3.5	3.5
23	2.7	1.9	3.1	5.3	3.1
24	3.1	2.5	3.9	4.2	3.4
25	4.5	1.8	4.2	4.5	4.6
26	2.8	1.1	2.9	5.4	4.5
27	2.9	3.1	4.6	1.7	5
28	3.6	2.9	5.4	1.7	4.3
29	4.2	2.6	4.9	1.8	4.4
30	3.5	4.3	5.1	6.7	4.2
31	2.9	4.7	3.5	1.9	4.1
32	2.8	2.6	2.5	2.5	3.3
33	3.8	4.2	5.2	3.1	3
34	3.8	4.6	3.9	2.9	2.7
35	2.6	3.7	5.3	3.6	5.7

Discussions on the result of the case of lateral displacement against all types of soil types, seismic zone 5.

In this case the different type of bracing systems is compared for different types of soils keeping zone factor as constant. The soil types are taken on x-axis and the lateral displacements are taken on y-axis and the lateral displacements are taken on y-axis. The graphs are plotted foe different type of loading conditions. It was observed that for different soil conditions (I, II, III) i.e., (Rock, Medium and Soft) the variation of roof displacement increases as the soil type goes from rocky to soft soil. The one reason for increment could be understood in terms of looseness of soil and the transfer of waves easily into the soil and transfer of these vibrations into the structure as displacement. The variation of roof displacements with respect to soil is about 18% from soil I to soil II and about 15% from soil II to soil III. This is true for all types of stories with different load conditions. The variation of lateral displacement due to change in soil type is effecting linearly. It is seen that the effect of x type of bracing system more is more effective among the configurations in controlling the lateral displacements in various multistoried building models considered.

Base Shear of different types of systems for all zones , for soil type III

Table 5.20: Showing Lateral displacements with respect to Storey Height, Loading Static and soil type III.

SEISMIC ZONES	BASE SHEAR				
	WITHOUT BRACE	X-BRACE	V-BRACE	INVERTED-V BRACE	ECCENTRIC BRACE
ZONE II	1441	1974	1856	1903	1734
ZONE III	2306	3076	2885	2981	2817
ZONE IV	3459	4563	4093	4212	4043
ZONE V	5189	7051	6843	6980	6453
ALL UNITS ARE IN KILONEWTON (KN)					

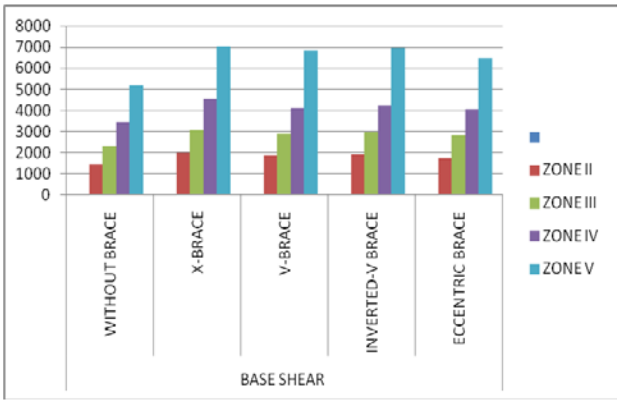

Fig: 5.21 Graph showing the variation of Base Shear against soil types with different lateral system.

Table 5.22: Showing Lateral displacements with respect to Storey Height, Loading Static and soil type II

SEISMIC ZONES	BASE SHEAR				
	WITHOUT BRACE	X-BRACE	V-BRACE	INVERTED-V BRACE	ECCENTRIC BRACE
ZONE II	1244	1713	1642	1688	1723
ZONE III	3240	3841	3640	3748	3852
ZONE IV	3240	3841	3640	3748	3852
ZONE V	4849	7739	7233	7398	8895
ALL UNITS ARE IN KILONEWTON (KN)					

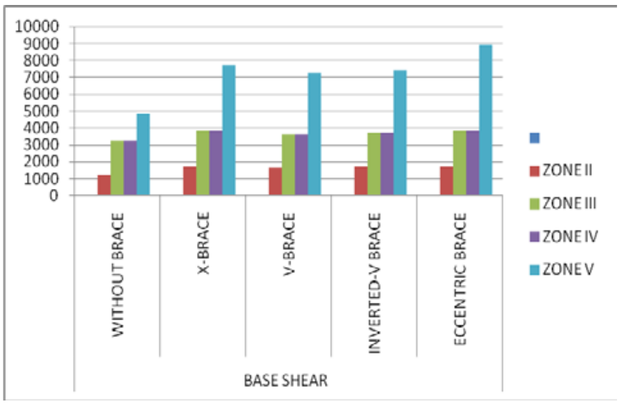

Fig:5.23:Graph showing the variation of Base shear against soil types with different lateral systems.

Table 5.24: Showing Lateral displacements with respect to Storey Height, Loading Static and soil type I

SEISMIC ZONES	BASE SHEAR				
	WITHOUT BRACE	X-BRACE	V-BRACE	INVERTED-V BRACE	ECCENTRIC BRACE
ZONE II	1325	1861	1753	1801	1935
ZONE III	2290	2865	2630	2671	3070
ZONE IV	3241	4083	3863	3963	4242
ZONE V	4851	6543	6210	6313	6140
ALL UNITS ARE IN KILONEWTON (KN)					

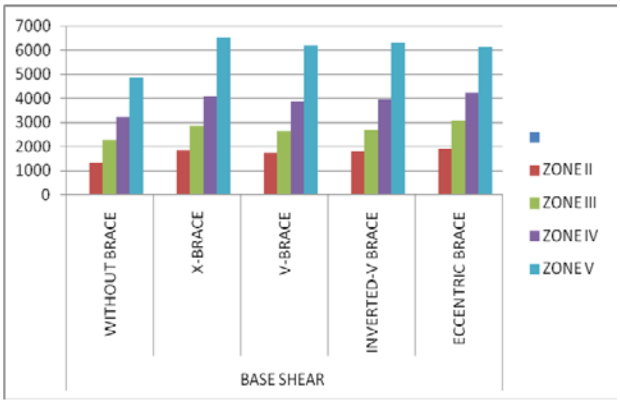

Fig: 5.25 Graph showing the variation of Base Shear against soil types with different lateral system.

Discussion of results for the case –Base shear of different types of systems with seismic zones and soil type III.

In this case the effect of base shear is study with reference to seismic zones. The seismic zones are taken on x-axis and base shear on y-axis , the graphs are plotted for different types of loading conditions. The observations made through this case study is, the base shear value increases with increase in of seismic zone. The percentage of increase is about 28% from Z2 to Z5foor different type of loading conditions.

VI. CONCLUSION

Based on the analysis carried out with an aim of achieving the defined objectives following are the conclusion s which are drawn.

i) The structural performance among the bracing systems (X-brace, V-brace, Inverted V-brace, Knee Bracings). The displacement at top roof level is relatively less for X-brace. This statement is true for all he zones and all the soil conditions and for different loading conditions.

ii) With the provision of bracings the stiffness of the structure is increasing and there by the base shear is decreasing with the increase in the height of the building.

iii) The value of displacements and base shears obtained in X-Brace, V-Brace and Chevron Brace structure models shows a considerable amount of variation in controlling lateral displacements.

iv) X-Brace being efficient in controlling the important parameter such lateral displacement and lateral drift can be used in high rise buildings.

v) The introduction of the bracing systems were fund to be effective in reducing the displacement , base shear and thereby increasing the stiffness of the building thus increasing the structural capacity of the structure to resist lateral loads due to earthquake.

vi) We have to define the materials for concrete and steel, add new material quick enter region as India, material as concrete, standard as Indian and grade as M20. It shows all default properties of the defined materials.

vii) The efficiency of the configuration of braces being used in buildings can be clearly understood by following analysis and depending upon the final result we can suggest the economical and best configuration of braces for considered building.

VII. FUTURE SCOPES

Future work can be carried out for across earthquake response of tall buildings with respect to structural systems. The different type of systems may be introduced for resisting the lateral forces. Lateral systems along with different type of combinations may be used for resisting lateral force. Analysis using better techniques, a detail dynamic analysis can be carried out, collecting the response of tall building in every mode. A study can be done to these lateral systems for making more effective in earthquakes as well as in wind forces resisting design. Anyhow many techniques are now available to make the structure stiff against the lateral forces. A study can be carried out by providing the base isolation techniques with these lateral forces or the springs to be provided with these systems, also we can make an investigation of dampers with these systems. author will explain the future of his/her research.

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