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Contrast of RC- Frame with Bracing and Shear Wall Structures

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ABSTRACT :In this review paper we are going to compare earthquake resistant structure i.e. RC- Frame , Bracing and Shear wall structure . And we will check which type of structure gives minimum deflection, storey drift, storey displacement as compared to RC- Frame . All the structure is made on Staad Pro , each one is G+11 . So in this we are going to conclude which structure is better in which case .Earthquakes are one of the greatest threats to life and property in the world. Because of the suddenness of the situation, they are incomprehensible and very frightening. Earthquake-resistant construction is considered to be very important in reducing its effects. This paper outlines the key elements of building earthquake resistance and a few strategies to improve the resistance of earthquake structures and structures, economically. Earthquake or aseismic structures are designed to protect buildings to a greater or lesser degree in earthquakes. Although no structure is completely immune to earthquake damage, the goal of earthquake-resistant construction is to stabilize buildings that move better during earthquakes than their regular counterparts. According to building codes, earthquake-resistant structures are intended to withstand the largest earthquake of a certain probability that is likely to occur at their location. This means the loss of life should be minimized by preventing collapse of the buildings for rare earthquakes while the loss of the functionality should be limited for more frequent ones.

KEYWORDS :- Earthquake Resistant Building , RC- Frame , Staad Pro , Bracing , Shear Wall , StoreyDrift , Storey Displacement

I. INTRODUCTION

In this paper we are going to talk about the high-rise earthquake resistance building. The impact of the earthquake on the building. How can we reduce the impact of the earthquake? Earthquakes are one of the most destructive of natural hazards. Earthquake occurs due to sudden transient motion of the ground as a result of release of elastic energy in a matter of few seconds. The impact of the event is most traumatic because it affects large area, occurs all on a sudden and unpredictable. They can impact like and society, property (Buildings, structure and their content) and disrupts lifeline Facilities (essential services such as water supply, transport etc.). They do not just destroy villages, town and cities but the consequences leads to destabilize the economic and social structure of the nation, and development. Earthquake is sudden rolling or shaking events caused by movement under the earth surface, resulting from the sudden release of energy in the earth's crust that creates seismic waves. Earthquakes are measured using observations from seismometers. Earthquake-resistant structures are those structures designed to withstand earthquakes. As there are no structure which can be 100 percent or totally invulnerable to damage from earthquakes, the primary objective of earthquake-resistant construction is to erect structures that fare better during seismic activity than their conventional counterparts. In this article we will discuss four techniques via which we can construct earthquake resistant structure so that the structure and the building will face least effects when earthquake occurs.

II. LITERATURE REVIEW

Manish Kumar Pandey (2021)-In his paper, it is presented that, the interest for multi-story structures is expanding step by step. Private in addition to business building is essentially utilized for wide range needs. Wide range expected

for Flat piece, Waffle section and ribbed chunk stands An incredible choice for engineers when bigger openings in a structure should be covered with as couple of segments as could be expected. The utilization of various sorts of plates is creating as a recent fad and is turning into a significant test for primary specialists. Subsequently, it is important to learn about its underlying way of behaving. The task is completed under quake zone III under the seismic tremor examination of G+9 story building. For this review, four distinct kinds of enormous range piece structure are demonstrated in C-shape (Horizontal Setback Building) having 10-stories for example G+9 celebrated structures with 3.50 meters level for every story is displayed and dissected. The arrangement region of each of the four structures is same for example 2859 square meters (49.50 m x 82.50 m) each. These structures were planned in consistence with the Indian Code of Practices for seismic tremor safe plan of structures. Base of the structure were fixed. The square segments are utilized for primary components. The level of the structures is viewed as steady all through the design.

III. METHODOLOGY

DESCRIPTION OF MODEL

Geometry : In this study a building regular plan is considered for analysis as show in figure . All stoeries including ground storey having 3 m floor to floor height . Area of the plan if building is 600 m^2 . Structure are having 5 bays in X-Direction and each bay is having a length of 6 m and in Z-Direction no. of bays are 4 with different length two corner or end bays having 6 m length and middle bays having length of 4 m each .

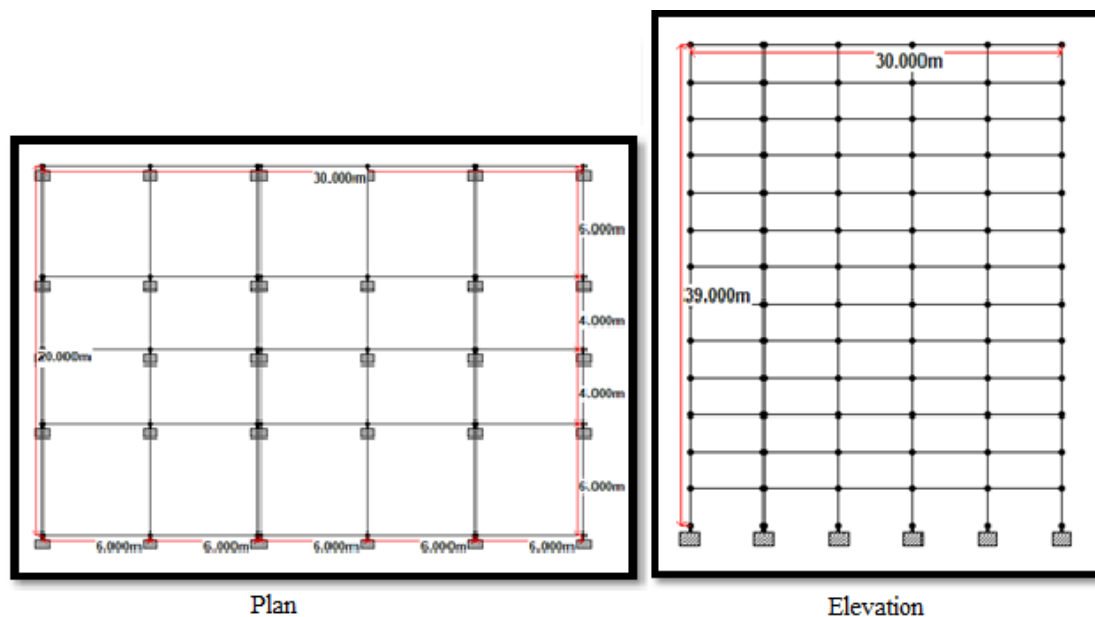


Figure 1 Plan And Elevation of RC- Frame Structure

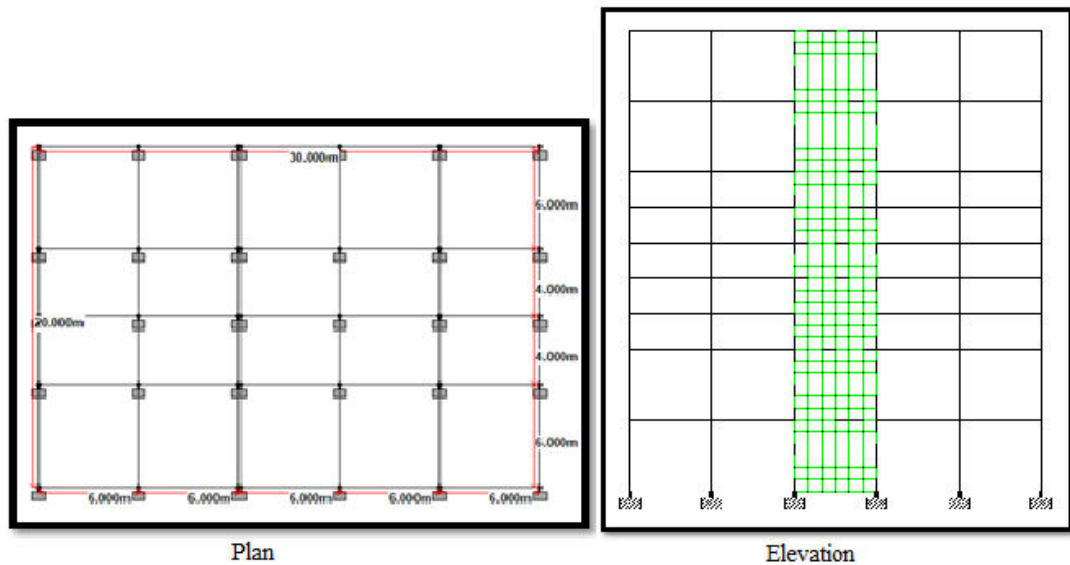


Figure 2 Plan and Elevation of Bracing Structure

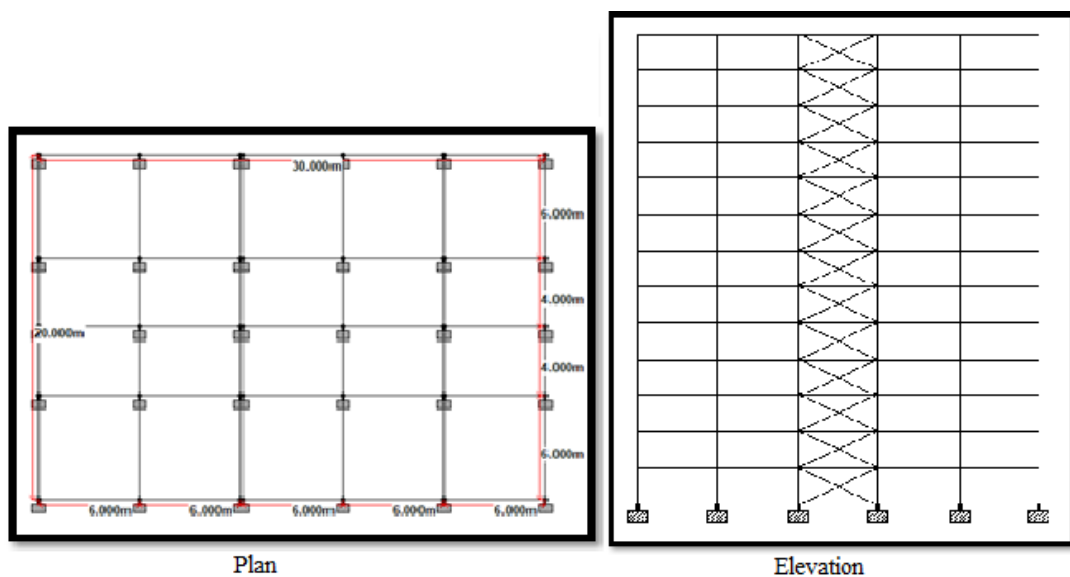


Figure 3 Plan and Elevation of Shear Wall Structure

BUILDING MODEL PROPERTIES

The Building considered in the project report is G+12 Storied R.C. Framed , Shear wall and Bracing Structure . the building has the following dimension.

- Length = 30 m
- Width = 20 m
- Height = 36 m (3 m each storey)
- M₃₀ Grade of Concrete
- F_e415 Grade of Steel

Size of plan G+11 Structure

- Size of Plan : 30m x 20m
- No. of bays in X- Direction : 5
- Length of each bay in X- direction : 6 m

- No. of bays in Z- Direction : 4
- Length of each bay in Z- direction : 6 m , 4 m , 4 m , 6 m
- Height of each story : 3m
- Area : 600 square meter
- Soil type : Medium , stiff
- Daming ratio : 5%
- Importance factor : 1.5
- Zone type : III
- Unit Weight of concrete : 25 KN/meter cube
- Unit weight of bricks : 19KN/ meter cube.

Table 1 Types of Walls Used

S.No	Type of Wall	Thickness (mm)
1.	OutterWall / Main Wall	230
2.	Inner / Partition Wall	115
3.	Parapet Wall	115
4.	Shear Wall	300

LOAD COMBINATION

Load combination that are used for Limit State Design of Reinforced concrete structure are listed below

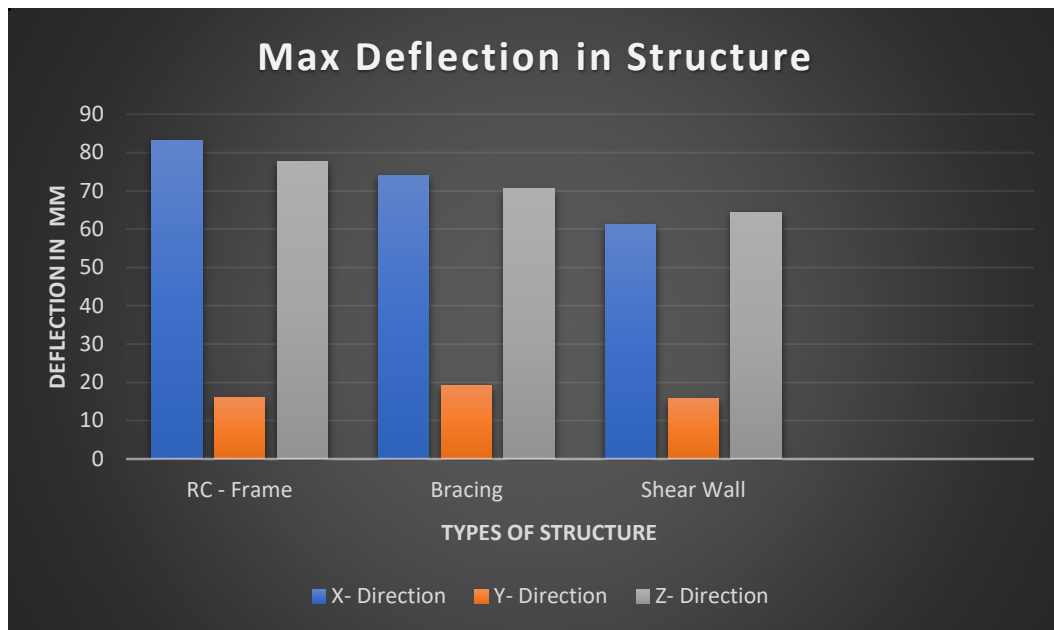
1. EQX+
2. EQX-
3. EQZ+
4. EQZ-
5. DL
6. LL
7. 1.2 (DL+LL+EQX+)
8. 1.2 (DL+ LL-EQX+)
9. 1.2 (DL+LL+EQZ+)
10. 1.2 (DL+LL+EQZ-)

IV.COMPARISION

COMPARISON FOR MAX DEFLECTION :- The table below followed by chart is the comparison of max deflection and all direction (i.e X, -X, Z, -Z, Y, -Y) between all the structure .

Table 2 Comparison for Max Deflection

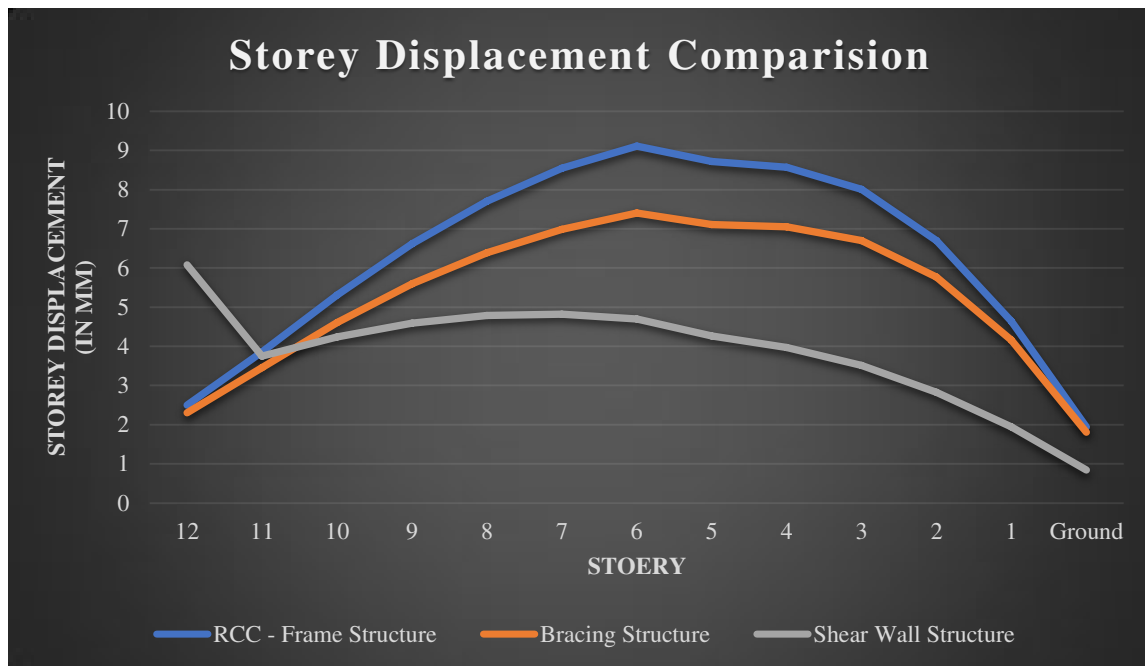
S.No.	Direction		Max Deflection (in mm)		
			RCC	Bracing	Shear wall
1.	X Direction	Maximum	83.025	74.049	61.252
		Minimum	-83.025	-74.049	-61.252
2.	Y Direction	Maximum	15.964	19.247	15.691
		Minimum	-15.964	-19.247	-15.691
3.	Z Direction	Maximum	77.580	70.540	64.454
		Minimum	-77.580	-70.540	-64.454



Graphs 1 Deflection in Structures

COMPARISION FOR STOREY DISPLACEMENT :-After comparing Story Displacement of all 3 strcture (RC Structure , Bracing Structure , Shear wall structure) we can conclude that brcing structure is 14.22155 % less story displacement and Shear wall structure has 28.74 % less story drift as compared to RC Structure .

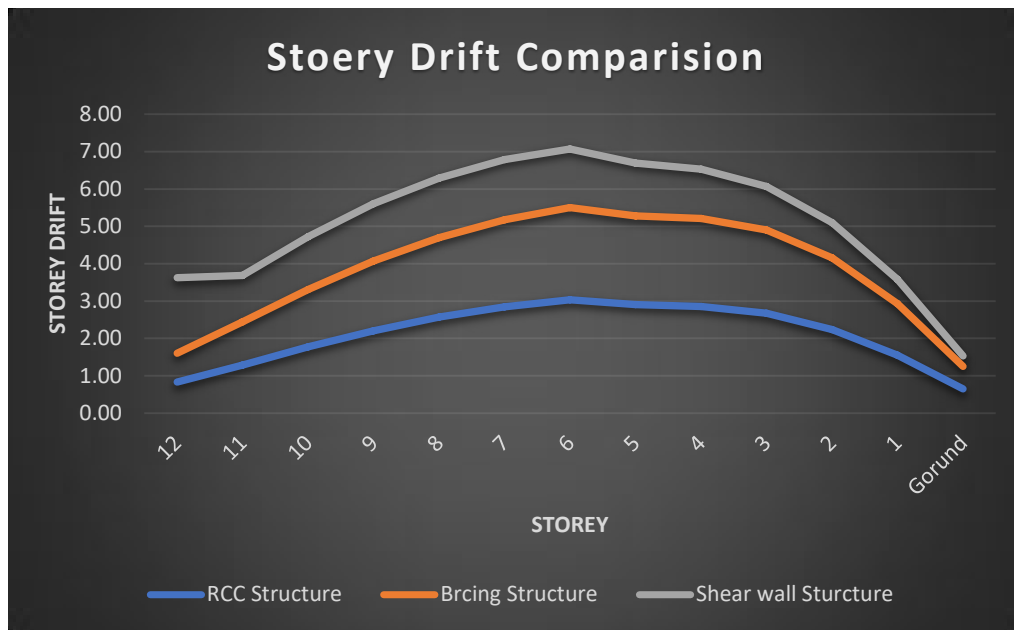
Storey	Heigh (in m)	STORY DISPLACEMENT (in mm)			Percentage Change story deflection w.r.t RC (a-x)*100/a	
		RCC Structure (a)	Brcing Structure (b)	Shear wall Sturcture (c)	Bracing	Shear Wall
Base = -3 m						
12	36	2.497	2.301	6.077	7.849419	-143.372
11	33	3.858	3.453	3.749	10.49767	2.825298
10	30	5.309	4.605	4.237	13.2605	20.19213
9	27	6.615	5.594	4.592	15.43462	30.58201
8	24	7.702	6.388	4.788	17.0605	37.83433
7	21	8.543	6.986	4.821	18.22545	43.56783
6	18	9.108	7.405	4.697	18.69785	48.42995
5	15	8.715	7.108	4.263	18.43947	51.08434
4	12	8.569	7.051	3.967	17.71502	53.70522
3	9	8.005	6.695	3.511	16.36477	56.13991
2	6	6.699	5.769	2.828	13.88267	57.78474
1	3	4.641	4.154	1.94	10.49343	58.19866
0	0	1.94	1.805	0.841	6.958763	56.64948
Average					14.22155	28.74014



Graphs 2 Storey Displacement in Structures

COMPASRISION FOR STOREY DRIFT :- As per the above comparision of storey drift we can conclude that storey drift in bracing structure and Shear wall Structure is less or is reduced as compared to the RC-Frame about 14.22 % and 28.74 % respectively .

Storey	Heigh (in m)	STORY DRIFT (in mm)			Percentage Change story deflection w.r.t RC (a-x)*100/a	
		RCC Structure (a)	Brcing Structure (b)	Shear wall Sturcture (c)	Bracing	Shear Wall
Base = -3 m						
12	36	0.83	0.77	2.03	7.85	-143.37
11	33	1.29	1.15	1.25	10.50	2.83
10	30	1.77	1.54	1.41	13.26	20.19
9	27	2.21	1.86	1.53	15.43	30.58
8	24	2.57	2.13	1.60	17.06	37.83
7	21	2.85	2.33	1.61	18.23	43.57
6	18	3.04	2.47	1.57	18.70	48.43
5	15	2.91	2.37	1.42	18.44	51.08
4	12	2.86	2.35	1.32	17.72	53.71
3	9	2.67	2.23	1.17	16.36	56.14
2	6	2.23	1.92	0.94	13.88	57.78
1	3	1.55	1.38	0.65	10.49	58.20
0	0	0.65	0.60	0.28	6.96	56.65
Average					14.22	28.74



Graphs 3 Stoery Drift in Structures

V. CONCLUSION

- From the deflection point of view, it is analyzed that braced structure and shear wall structure reduces maximum deflection at the top storey as compared to RC-frame. Hence, it can be concluded that shear wall structure is more effective in high rise building for reducing maximum deflection.
- From storey displacement point of view, it is analyzed that reduction in bracing and shear wall structure is about 15% and 29% as compared to RC-frame structure. Hence, it can be concluded that in high rise building maximum displacement is controlled by using shear wall.
- From storey drift point of view the conclusion is same as for storey displacement here also shear wall structure better for storey drift reduction.

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