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# Comparative Study of Primary Steel Rebar used in High-Rise Building in Construction Industries

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**ABSTRACT:** Steel concrete composite structures are widely known around the world for their construction of various types of structures. In India, the steel used in various industries is less than in other developed countries. Various types of steel backs are used in construction, some in search order. Different steel industries aim to achieve the highest strength and durability by satisfying the characteristics of steel bars. The articles review the various research activities related to the new approach adopted for the construction of steel bars for concrete structures. Various papers are based on the summery report. A review of the articles concludes on the current state of the industry and the desire to support and develop new approaches to advanced technology. Different models are G + 6, G + 8. The structure is earthquake analysed based on response spectrum analysis.

**KEYWORDS:** Primary Bar, Concrete Structure, New Techniques, response spectrum analysis

## I. INTRODUCTION

Steel is an alloy of iron and carbon of all building materials currently in use, and steel is the most versatile and versatile building material. It is well known that steel has a structure that no one else can. The strength and strength of the steel do not match the wood or concrete. The steel structure is a set of group members that are expected to continue. Steel is very elastic, fibrous, flexible and can be used. Steel has high tensile and compressive strength and is more durable to wear. The most important property of steel used in large-scale construction is its flexibility and can be bent without cracking. The steel structure is especially suitable for energy dissipation. Steel is a high-strength material per unit mass. The function of a structured structure is to strengthen it without excessive damage, such as wind, earthquake, or load failure or overload. It is important to understand the seismic and seismic tectonics of the regions. Steel is one of the most widely used building materials in the world. The strength, toughness and high elasticity of steel are good characteristics for seismic design. To achieve these advantages in seismic applications, the design engineer must be familiar with the purpose set out in the relevant steel design rules and codes. Today, as we all know, the construction industry is rapidly exploring and incorporating new methods for fast and convenient farming. Basic building material concrete plays an important role in this sector. The main component of concrete is both expensive and natural resources on the threshold of price. So finding an alternative is very important.

## II. OBJECTIVES OF THE RESEARCH

- To study the various cases of primary and secondary steel rebar usage by using Response Spectrum Method of dynamic analysis using Staad pro software.
- To model the various models of G+6, 8& 10 with various steel materials.
- To explore the possibilities of overall structural resistance by different types of material usage.
- To compare the research gap of whether primary steel performs well or secondary steel performs well in combination of RCC.



**III. METHODOLOGY AND STRUCTURAL MODELING**

Various models are framed for analysis and assessment of structure to accomplish the aforesaid objectives of the current study.

**Table 1:** List of buildings framed with assigned abbreviations

S. No.	Abbreviation	Description of Cases
1.	<b>PS Case 1</b>	Commercial building with G+6 configuration using Secondary Steel Rebar
2.	<b>PS Case 2</b>	Commercial building with G+6 configuration using Primary Steel Rebar
3.	<b>PS Case 3</b>	Commercial building with G+8 configuration using Secondary Steel Rebar
4.	<b>PS Case 4</b>	Commercial building with G+8 configuration using Primary Steel Rebar

**Note:** Here PS is abbreviated as Primary Steel comparison case.

**Table 2:** Property of Steel rebar used for modeling

S. No.	Structure Type	Values Used
1.	Structure modeled using Secondary Steel Rebar	$Y_s = 500$ Mpa (Value taken as per IS 1786:2008)
2.	Structure modeled using Primary Steel Rebar	$Y_s = 575$ Mpa (Value taken as per Test Report)

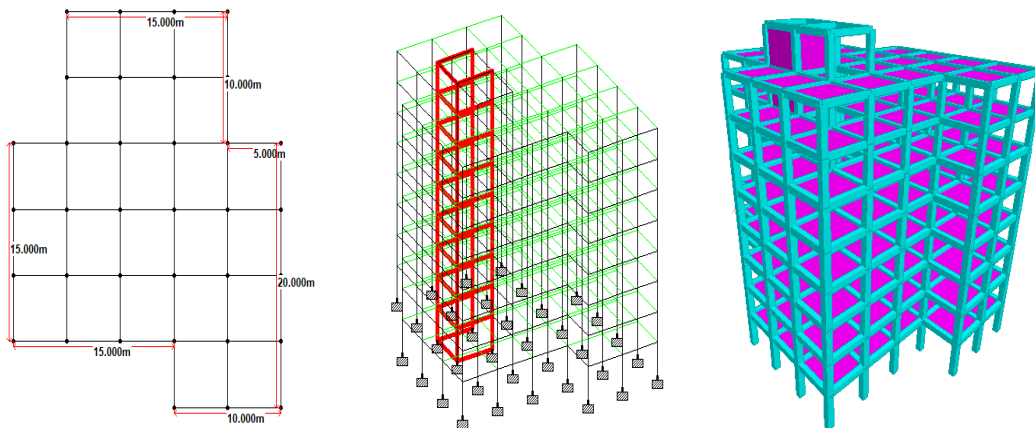
**Seismic & Structural parameters:**

**Table 3:** Data assumed for analysis of structure

Constraint	Assumed data for all buildings
Soil type	Medium Soil
Building type	Commercial Building (G+6), (G+8), (G+10)
Seismic zone	III
Response reduction factor (ordinary shear wall with SMRF)	4
Damping ratio	5%
Importance factor (For all semi commercial building)	1.5
Plinth area of building (For Single Core)	575 sq. m
Floor to floor height	3.66 m
Depth of foundation	4 m
Beam sizes	650 mm X 550 mm, 550 mm X 350 mm 450 mm X 300 mm
Column sizes	750 mm X 650 mm, 650 mm X 550 mm 500 mm X 450 mm
Slab thickness/ Staircase waist slab thickness	125 mm (0.125 m)
Shear wall thickness	130 mm (0.130 m)
Concrete properties	M 25 Concrete
Steel properties	(1) Primary (as per Test certificate company) (2) Secondary (as per IS 1786:2008)



**DETAILS OF THE BUILDING MODELS**



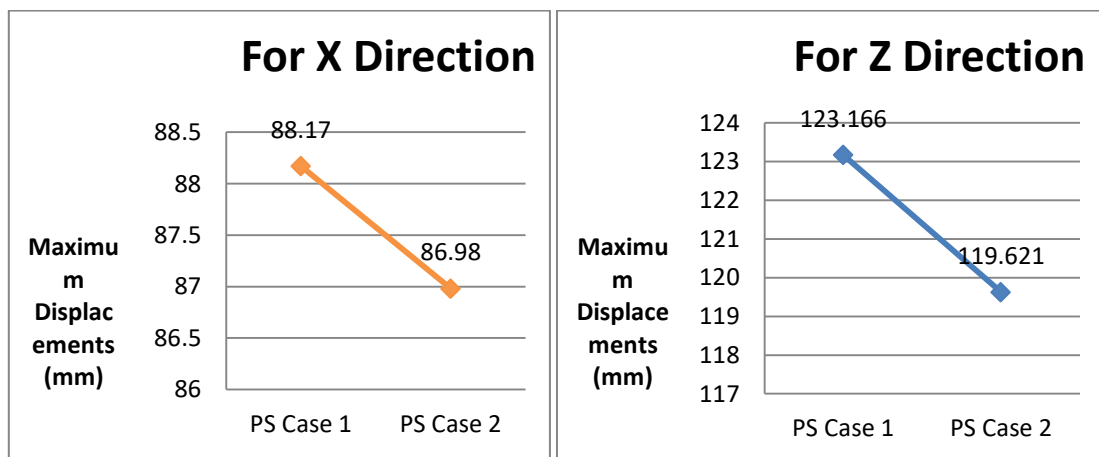
**Fig. 1 a) Plan**      **b) 3- D view of all buildings**      **c) Actual Rendered view of all building**

**IV. RESULT & DISCUSSIONS**

**Discussions between G+6 structures**

**Table 4 :** Maximum Displacement in X direction for both G+6 Structures

Case	Maximum Displacement(mm)	Maximum Displacement(mm)
	For X Direction	For Z Direction
Building with Secondary Steel Rebar	88.170	123.166
Building with Primary Steel Rebar	86.980	119.621

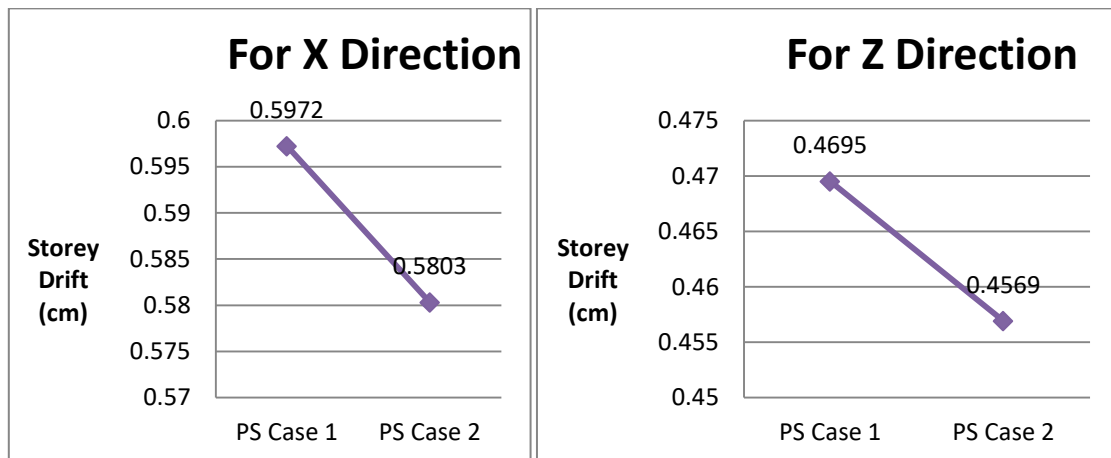


**Fig. 2:** Maximum Displacement in X & Z direction for both G+6 Structures



**Table 5:** Storey Drift in X direction for both G+6 Structures

S. No.	Height (m)	Storey Drift (cm)			
		For X Direction		For Z Direction	
		Building with Secondary Steel Rebar	Building with Primary Steel Rebar	Building with Secondary Steel Rebar	Building with Primary Steel Rebar
1	0	0	0	0	0
2	4	0.2564	0.2489	0.2113	0.2052
3	7.66	0.4166	0.4045	0.3089	0.3000
4	11.32	0.5071	0.4925	0.3352	0.3255
5	14.98	0.5621	0.5460	0.3342	0.3246
6	18.64	0.5842	0.5675	0.3147	0.3057
7	22.30	0.5710	0.5548	0.2803	0.2724
8	25.96	0.5972	0.5803	0.2823	0.2744
9	29.62	0.5332	0.5180	0.2209	0.2145
10	33.28	0.5179	0.5030	0.4695	0.4569



**Fig. 3:** Storey Drift in X & Z direction for both G+6 Structures

**Table 6:** Base Shear in X and Z directions for both G+6 Structures

Case	Base Shear(KN)	
	X direction	Z direction
Building with Secondary Steel Rebar	7023.76	8474.81
Building with Primary Steel Rebar	6918.70	8032.52

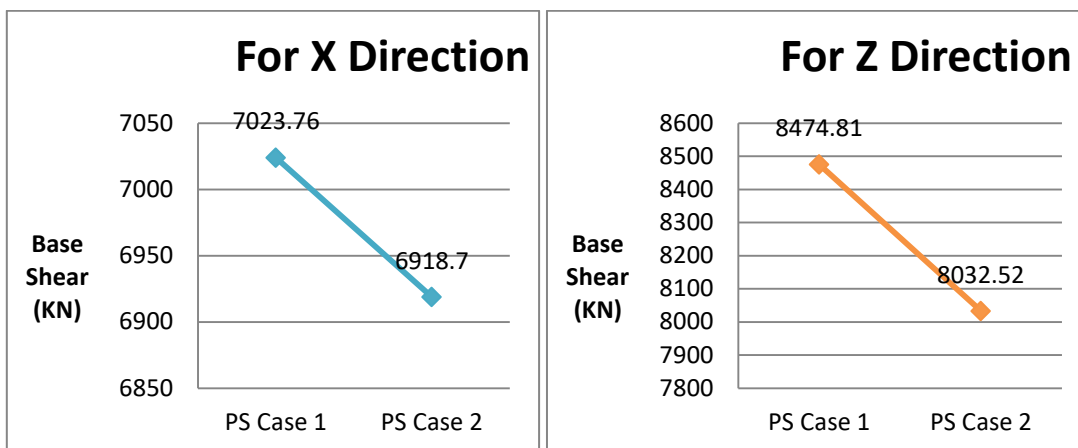


Fig. 4 : Base Shear in X & Z direction for both G+6 Structures

Table 7: Maximum Axial Forces in Column for both G+6 Structures

Case	Column Axial Force (KN)
Building with Secondary Steel Rebar	9399.856
Building with Primary Steel Rebar	9115.934

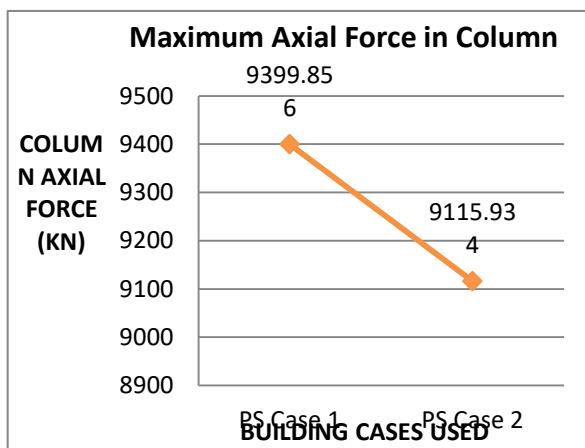


Fig. 5: Max. Axial Forces in Column for both G+6

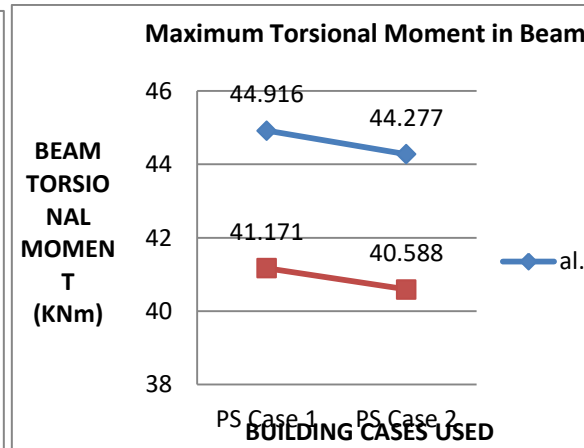


Fig. 6 : Max. Torsional Moment in beams

Table 8: Maximum Torsional Moment in beams along X and Z direction for both G+6 Structures

Case	Beam Torsional Moment (along X direction)(KNm)	Beam Torsional Moment (along Z direction)(KNm)
Building with Secondary Steel Rebar	44.916	41.171
Building with Primary Steel Rebar	44.277	40.588



Fig. 4.17: Maximum Torsional Moment in beams along X and Z direction for both G+6 Structures

Discussions between G+8 structures

Table 9: Maximum Displacement in X direction for both G+8 Structures

Case	Max. Displacement (mm)	Max, Displacement (mm)
	For X Direction	For Z Direction
Building with Secondary Steel Rebar	123.470	172.851
Building with Primary Steel Rebar	119.903	167.827

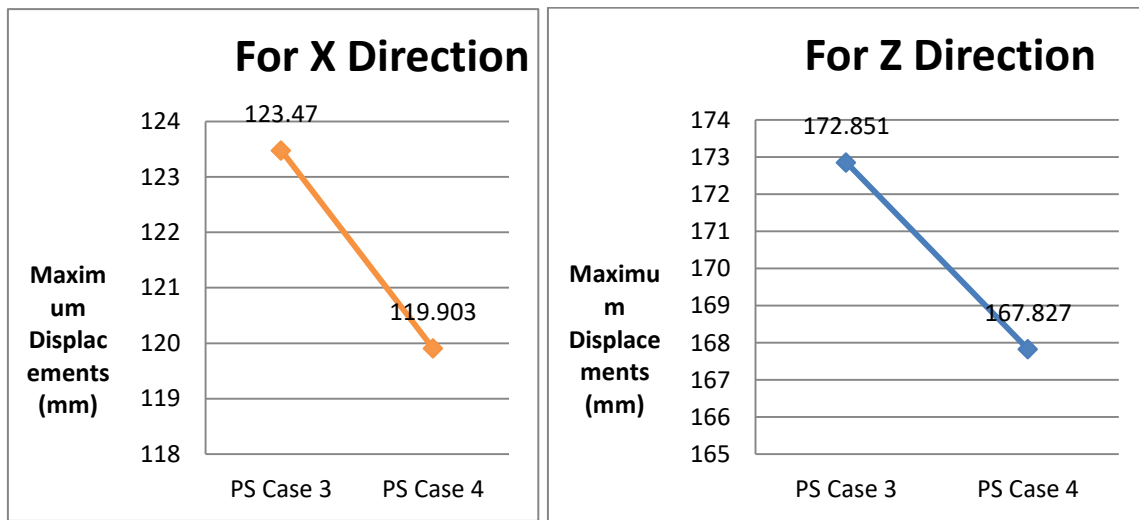


Fig. 7: Maximum Displacement in X & Z direction for both G+8 Structures

Table 10: Storey Drift in X & Z direction for both G+8 Structures

S. No.	Height (m)	Storey Drift (cm)			
		For X Direction		For Z Direction	
		Building with Secondary Steel Rebar	Building with Primary Steel Rebar	Building with Secondary Steel Rebar	Building with Primary Steel Rebar
1	0	0	0	0	0
2	4	0.3390	0.3293	0.2190	0.2127
3	7.66	0.5630	0.5468	0.3231	0.3139
4	11.32	0.7025	0.6823	0.3551	0.3450
5	14.98	0.8018	0.7788	0.3627	0.3524
6	18.64	0.8639	0.8392	0.3574	0.3473
7	22.30	0.8818	0.8566	0.3447	0.3350
8	25.96	0.9817	0.9536	0.4056	0.3942
9	29.62	0.9971	0.9685	0.3980	0.3866
10	33.28	0.9350	0.9079	0.3169	0.3076
11	36.94	0.8081	0.7844	0.2282	0.2101
12	40.60	0.8533	0.8292	0.7167	0.6973

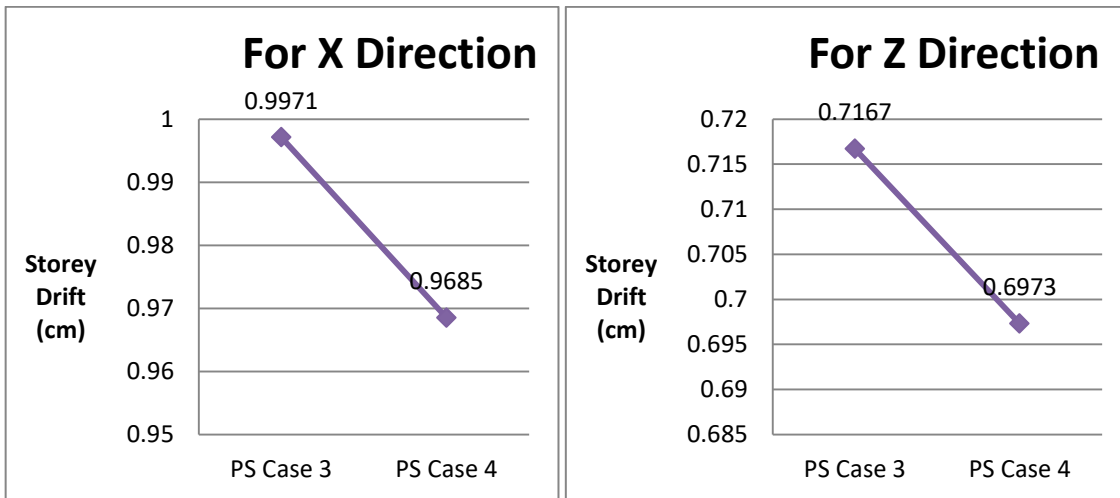


Fig. 8: Storey Drift in X & Z direction for both G+8 Structures

Table 11: Base Shear in X and Z directions for both G+8 Structures

Case	Base Shear(KN)	
	X direction	Z direction
Building with Secondary Steel Rebar	6833.38	8234.35
Building with Primary Steel Rebar	6719.39	8118.54

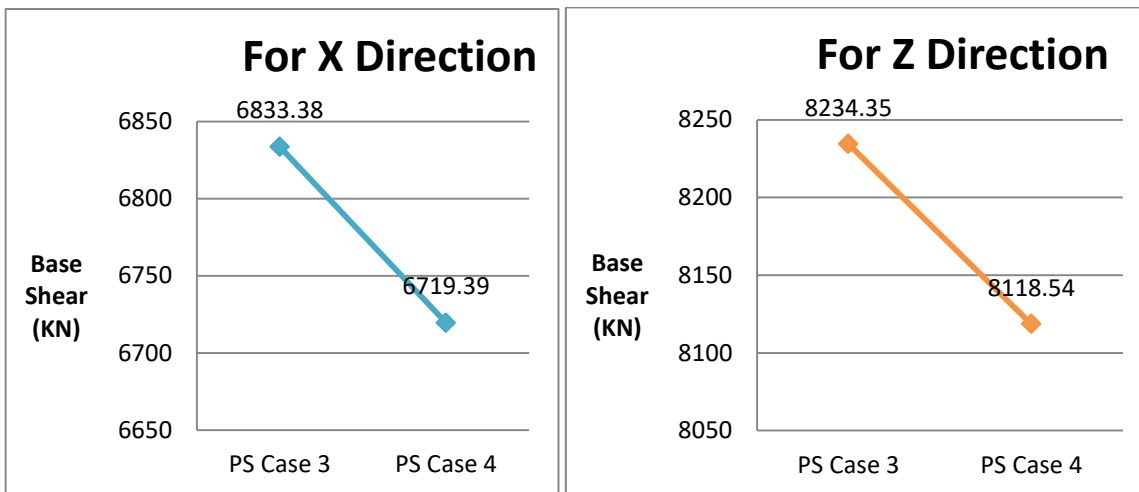


Fig. 9: Base Shear in X & Z direction for both G+8 Structures

Table 12: Maximum Axial Forces in Column for both G+8 Structures

Case	Column Axial Force (KN)
Building with Secondary Steel Rebar	11179.947
Building with Primary Steel Rebar	10844.598



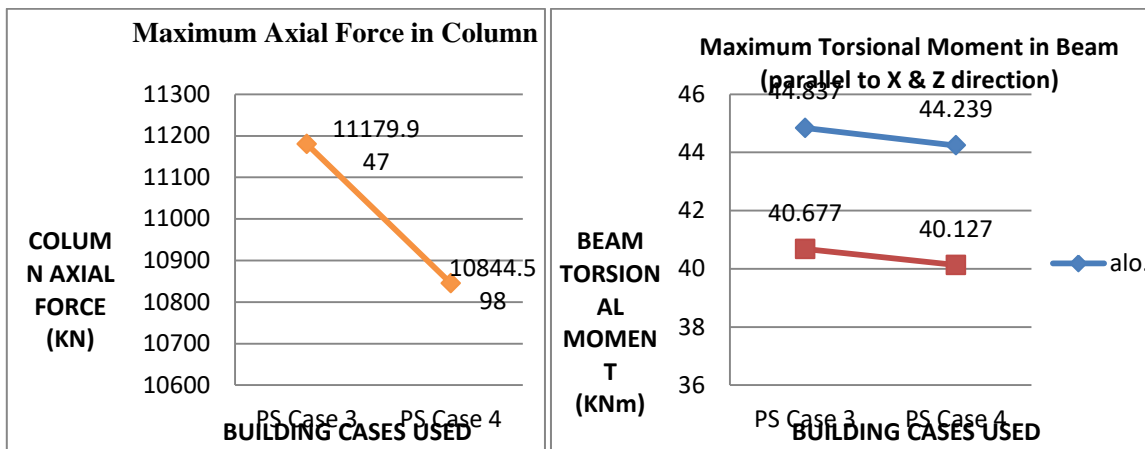


Fig. 10 : Max. Axial Forces in Column for G+8 Fig. 11: Max, Torsional Moment in beams for G+8

Table 13: Maximum Torsional Moment in beams along X and Z direction for both G+8 Structures

Case	Beam Torsional Moment (along X direction) (KNm)	Beam Torsional Moment (along Z direction) (KNm)
Building with Secondary Steel Rebar	44.837	40.677
Building with Primary Steel Rebar	44.239	40.127

#### IV. CONCLUSIONS

##### G+ 6 Structures

- The usage of Primary Steel Rebar used in G+6 High-rise Building in Construction Industry made a great effect on displacement in X and Z direction with reduction of 1.19mm in X direction and 3.545 mm in Z directions for maximum displacement parameter.
- On comparing both steel rebar 0.0169 cm reduction observed in Storey drift in X direction and 0.0126 cm reduction observed in Storey drift in Z direction parameter respectively.
- Again reduction values obtained for Base Shear parameter of 105.06 KN for X direction and 442.29 KN for Z direction.
- The next parameter is Axial Forces in column, the reduction has observed to be 283.922 KN which has observed to be a great achievement.
- Torsional Moment parameters in all the beams again have observed reduction of 0.639 KNm and 0.583 KNm respectively.

##### G+8 Structure

- The usage of Primary Steel Rebar used in G+8 High-rise Building in Construction Industry made a great effect on displacement in X and Z direction with reduction of 3.567 mm in X direction and 5.024 mm in Z directions for maximum displacement parameter.
- On comparing both steel rebar 0.0286 cm reduction observed in Storey drift in X direction and 0.0194 cm reduction observed in Storey drift in Z direction parameter respectively.
- Again reduction values obtained for Base Shear parameter of 113.99 KN for X direction and 115.81 KN for Z direction.
- The next parameter is Axial Forces in column, the reduction has observed to be 335.349 KN which has observed to be a great achievement. With a reduction value of 7.955 KN observed for Shear forces in Y axis and reduction value of 8.416 KN observed for Shear forces in Z axis respectively for Column Shear Forces parameter.
- Now, for both directions, the Torsional Moment parameters in all the beams again have observed reduction of 0.598KNm and 0.55KNm respectively.



**The research finished with the conclusion that with the use of primary steel rebar in RCC, each case works better than secondary rebar usage and obtained as efficient Case and will be recommended to reduce the structural failure and will reduce sizes of the structural members.**

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