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TO INVESTIGATE EFFICIENT CONCENTRIC BRACING SYSTEM IN HIGH RISE STEEL STRUCTURE

Amol Patil[1], Rohit Shintre[2] , Saikedar Patil[3]

[1] Assistant Professor, Department of Civil Engineering,
Nanasaheb Mahadik College of Engineering, Peth, Maharashtra, (India)
[2,3]Students, Department of Civil Engineering,
Nanasaheb Mahadik College of Engineering, Peth, Maharashtra, (India)

ABSTRACT

The aim of present study, "To investigate efficient bracing system in high rise steel structure" by using STAAD.pro v8i. The objective of this paper is to analysis and design different parameter in high rise steel structure by using staad.pro v8i. In this paper G+20 storied building considered and various lateral load like wind load and seismic load. Analysis the result obtained in staad.pro for efficient bracing system.

Key words: Bracing system, High rise steel structure, Lateral loads.

I. INTRODUCTION

In every human citizen need a structure like Building structures, as well as these structure also efficient so it can made with efficient nature like good strength, good life so here important role of civil engineering and more precise analysis of building structures. But, now day's population of our country increases day by day so problems are generated of shortage of land. So we need to built high rise steel structure. In Building structures, lateral loads are act. So we need to resist the lateral loads by using lateral load Resisting system like shear wall and Bracing system. To show the effect of different types of bracing systems in high rise steel buildings, for this purpose G+ 20 multi-storied steel building models is used with same configuration and different bracing system is used. A commercial software package STAAD.Pro V8i is used for analysis of steel building and different parameter are compared.

II. OBJECTIVE

- To study the role of bracing system in high rise steel structure.
- Analysis and design different parameter in high rise steel structure by using STAAD pro v8i
- To study the behavior of high rise steel structure with and without bracing system in different load condition.
- To investigate efficient bracing system in high rise steel structure by following point of view

- Lateral displacement
-Base shear
-Total weight

III. METHODOLOGY

1.Collection of relevant present work through journals, technical magazines, international technical papers, Proceeding reference books and through internet

2.Analysis and design of high rise steel structures by using staad.pro v8i.

3. Analysis the result obtained in staad.pro for efficient bracing system and behavior of high rise steel structure in different load conditions.

IV. MODELING

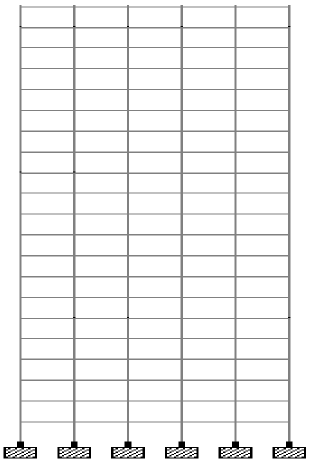
In this paper, G+20 high rise steel structure having plan size 20m x 20m for a x and z direction respectively. Floor to floor height of building is 3m and 5 bays of 4m each along x and z direction. The lateral loads act on building based on Indian Standard. The building is construct on zone III as per IS 1893 (part I) 2002 and basic wind speed 39m/s as per IS 875 Part3 1987. For this site location medium soil strata is assume.

4.1 Beams and column schedule

Floor	Column section
1 to 11	UPT12 section
12 to 14	ISWB600400 x 2040
15,16	ISWB600350 x 2040
17,18	ISWB550350 x 2040
floor	Beam Section
All (Inner and Outer beam)	ISLB400
Bracing angle section	ISA 120 x 80 x 12
Eccentricity of eccentric bracing system	750 mm

4.2 UPT 12 section property:

D	1000 mm
Tf	50 mm
Wf	400 mm
Tw	30 mm
Tf1	50 mm



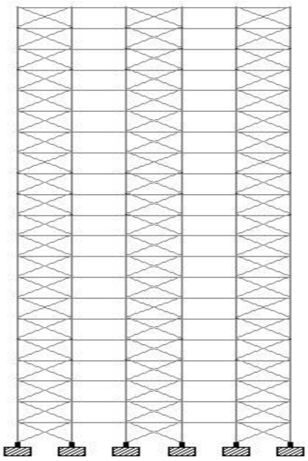
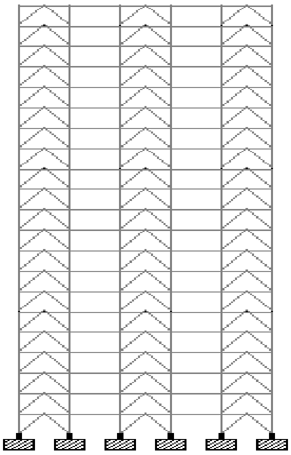


Fig no.1-Without brace Fig no.2- Concentric x- brace



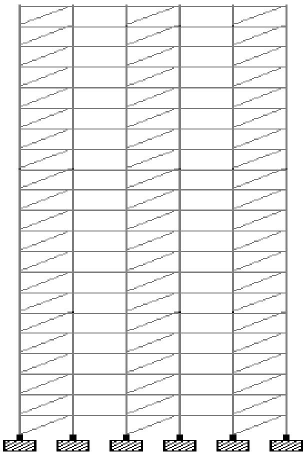


Fig no.3- Concentric Invered V brace Fig no.4- Concentric Single Diagonal brace

V. LOADING

5.1.Dead load

Self weight of R.C.C slab -

Self weight = thickness x Density

= 0.150 x 25

= 3.75 kn/m2

Assume floor finish = 1 kn /m2

Total self weight of slab = 4.75 kn /m2

Calculation of self weight of brick wall having 12 mm plastering:-

Thickness of brick wall = 230 mm

Total self weight of brick wall = (0.230 x 20 x 3) + 2 (0.012 x 22 x 3)

=15.38 KN /M

5.2. Live load: 2 kn / m2 over a slab up to 63 floors

5.3. Seismic load: According to I.S 1893-2002 part 1 the design horizontal seismic coefficient Ah for a structure shall be determined by following expression:

$$Ah = \frac{Z\ I\ Sa}{2\ R\ g}$$

Zone factor, Z	0.16 for zone III
Importance Factor, I	1.5
Type of soil	Medium Soil
Response reduction factor, R for without and with braced models.	5
Fundamental Damping ratio	0.05

5.4. Wind load:

It can be mathematically expressed as follow:

Vz = Vb x k1 x k2 x k3

Basic wind speed, Vb	39m/s
Risk co-efficient factor, K1	1.06
Terrain, Height and structure size factor, K2	Varies with respect to height
Topography factor, K3	1

VI. RESULT

All loads and load combinations are considered for the comparison but results are presented for maximum load cases.

6.1.Maximum joint displacement at top storey in z direction.

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Model	Lateral displacement
Without brace	285.978
Conc. X- brace	255.849
Conc. Inverted V-brace	261.545
Conc. Single diagonal brace	264.057

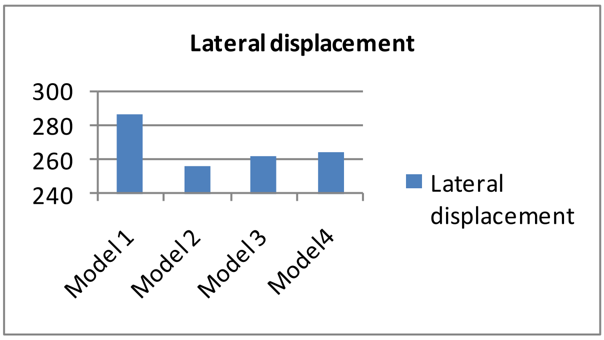

Fig.5 Show maximum joint displacement at top storey in z direction.

The base shear of concentric X-bracing model have least lateral displacement value.

6.2 Base shear :

Models	Base shear (KN)	
	X- Direction	Z-Direction
Model 1	3057.47	2658.27
Model 2	3435.14	2798.29
Model 3	3429.45	2802.37
Model4	3426.34	2802.67

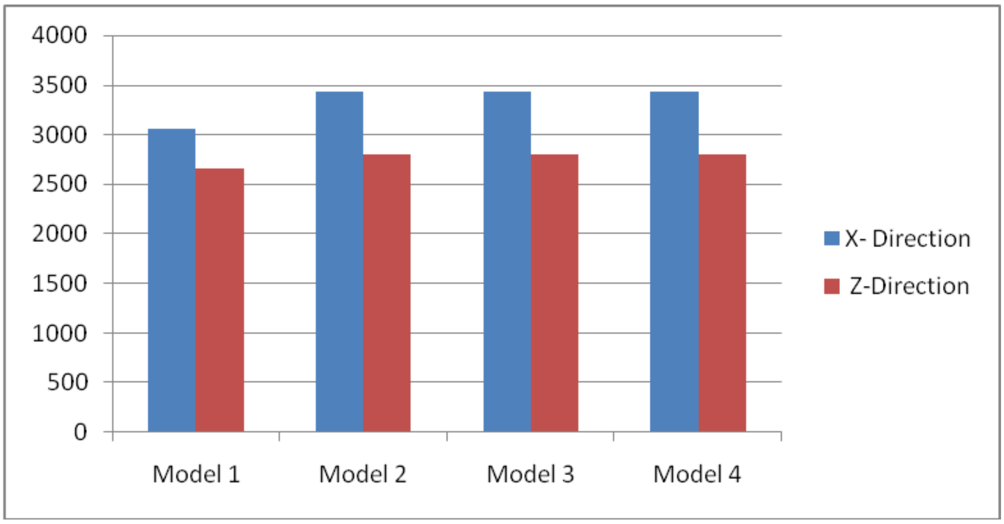

Fig.6 Show maximum base shear in X and Z direction

The concentric X-bracing system have more value of base shear in both direction

6.3. Total weight:

MODELS	TOTAL WEIGHT IN KN.
Model 1	$1.138X10^5$
Model 2	$1.114X10^5$
Model 3	$1.14X10^5$
Model4	$1.1448X10^5$

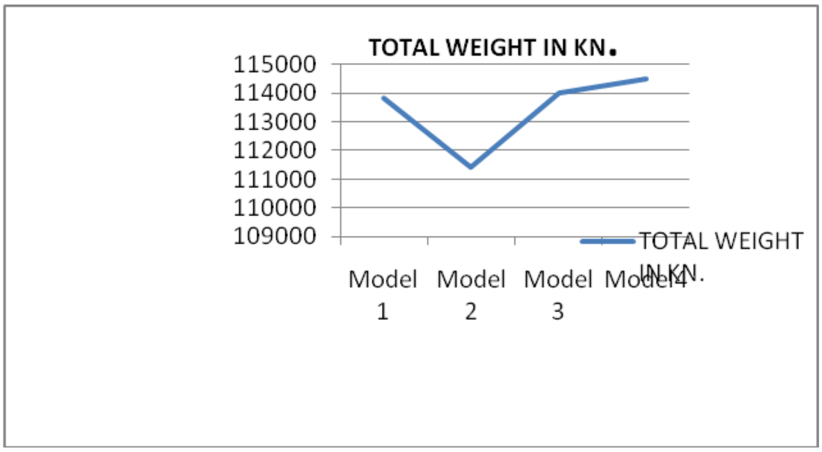

Fig no.7 Total weight of building

In Concentric single diagonal bracing system value of total weight of structure in more as compare to other models.

VII. CONCLUSION

1. Concentric x bracing system have least lateral displacement with respect to storey height when compare to without braced model and other braced models. It reduces its value by 10.53%
2. Concentric x-bracing system have more base shear as compare to without braced and other models. Base shear in the x-bracing system increases value up to 13.17%.
3. Total weight of structure is increases in single diagonal bracing system.

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8.3.) IS Codes:

[1] IS : 875 (Part 1) : 1987 Dead Loads

[2] IS : 875 (Part 2) : 1987 Imposed Loads

[3] IS : 875 (Part 3) :1987 Wind Loads

[4] IS : 1893(Part 1) : 2002 Earthquake load

[5] IS : 800:2007 General Construction In Steel