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NON-LINEAR ANALYSIS OF HIGH RISE STEEL FRAME STRUCTURE WITH DIFFERENT BRACING CONFIGURATION

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ABSTRACT

A Bracing is a system that is provided to minimise the lateral deflection of structure. The members of a braced frame are subjected to tension and compression, so that they are provided to take these forces similar to a truss. Braced frames are always designed of steel members. Use of the braced frames has become very popular in high rise structure and also in seismic design of them. So this paper is aims to investigate the performance of steel Braced Frames for steel frame structure. In these project a steel building model is taken, these model is compared in different aspects such as storey drift and story displacement etc. using different section in different locations. Among these numbers of trial which type of bracing at which location is more suitable from the observed results would be selected for the structure.

Keywords-- Axial force in column, Bracing system, Storey displacement, Storey drift.

I. INTRODUCTION

The High rise steel structures are now a day's very popular because of the ease of erection and high strength weight ratio. The stability of the high rise structures from the lateral loads like wind and earthquake is important. The structure can be stabilizing by using the bracing system, moment resisting connections, and also a shear wall. But the mostly favourable type to resist these lateral loads is bracing system in steel structure. The suitability of the bracing system is depends upon the behaviour of the bracing to the lateral loads act on the structure. The IS 1893:2002 is used for the earthquake load calculation. In this project a steel building model is taken, this model is compared in different aspects such as storey drift and base shear etc. using different bracing configuration in different locations. After the numbers of trial the results of seismic analysis of high rise steel building with different pattern of bracing system which type of bracing at which location is more suitable would be selected for the structure.

II. STEEL BRACING SYSTEM

Bracing is a highly efficient and economical method to laterally stiffen the frame structures against wind and other lateral loads. A braced bent consists of usual columns and girders whose primary purpose is to support the gravity loading, and diagonal bracing members that are connected so that total set of members forms a vertical

cantilever truss to resist the horizontal forces. Bracing is efficient because the diagonals work in axial stress and therefore call for minimum member sizes in providing the stiffness and strength against horizontal shear.

III. PROBLEM MODELLING

Table 1: Problem Statement for analysis

Name of parameter	Value	Unit
Number of stories	15	Nos
Storey height	3	M
Total height of the structure (above GL)	47	M
Length in long direction	30	M
Length in short direction	13	M
Thickness of Deck	200	M
Dead Load (1) Wall	11.9	KN/M
(2) Floor finish	1.5	KN/M²
Live load	2	KN/M²
Earthquake Parameters		
a. Earthquake Code	IS 1893: 2002	
b. Seismic Zone	III	
c. Importance Factor	1	
d. Response Reduction factor	5	
e. Soil Parameter	Hard soil	

A. Model Description

Model 1: Normal building

Model 2: Building having diagonal bracing

Model 3: Building having X bracings

Model 4: Building with V bracings

Model 5: Building inverted V bracings

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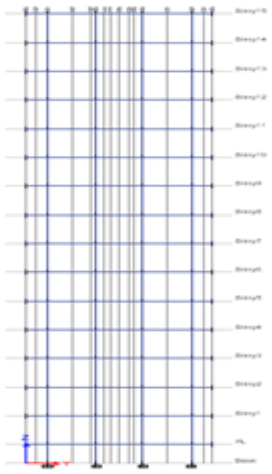

Figure 1: Model 1Normal

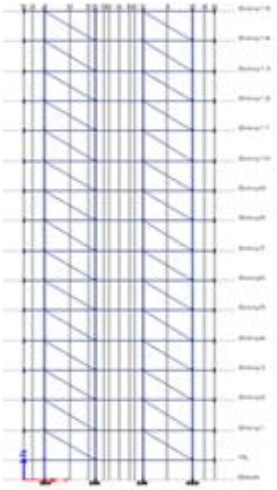

Figure 2 : Model 2 Building having diagonal bracing

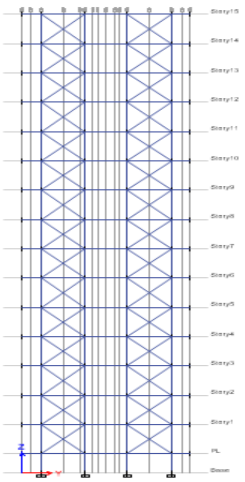

Figure 3: Model 3 Building having X bracings

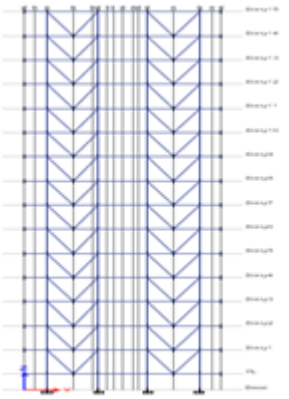

Figure 4: Model 4 Building with V bracings

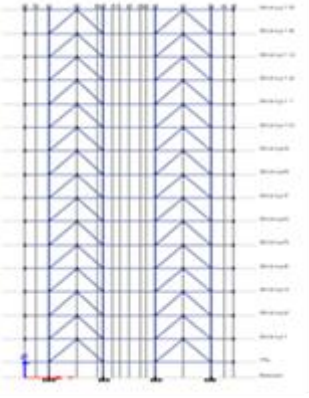

Figure 5 : Model 5 Building inverted V bracings

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IV. RESULT AND DISCUSSION

Models	Displacements (mm)	% Reduction in
Model 01	100.7	-
Model 02	73.9	36.26
Model 03	72.1	39.66
Model 04	78.4	28.44
Model 05	75	34.26

Table - 2: Maximum lateral displacements in X direction

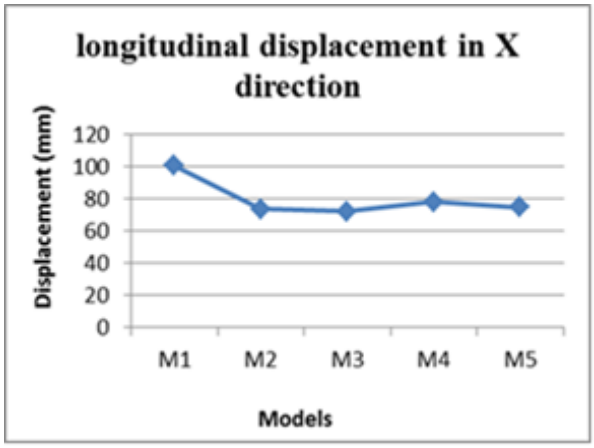

Figure. 6 Maximum lateral displacements in X direction

Models	Displacements	% Reduction in displacement
Model 01	86.9	-
Model 02	59.5	46.05
Model 03	58.2	49.31
Model 04	63.1	37.71
Model 05	60.9	42.69

Table - 3: Maximum lateral displacements in Y direction

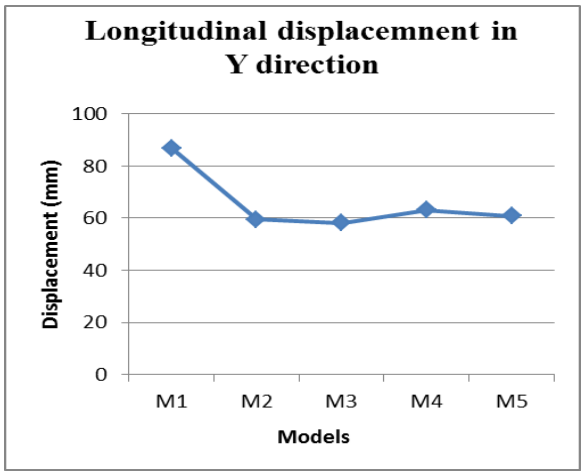

Figure 7: Maximum lateral displacements in Y direction

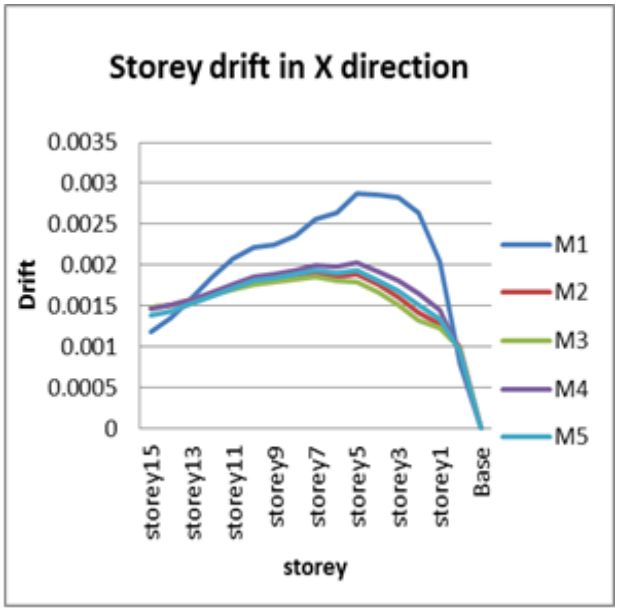

Figure 8: storey drift in X direction

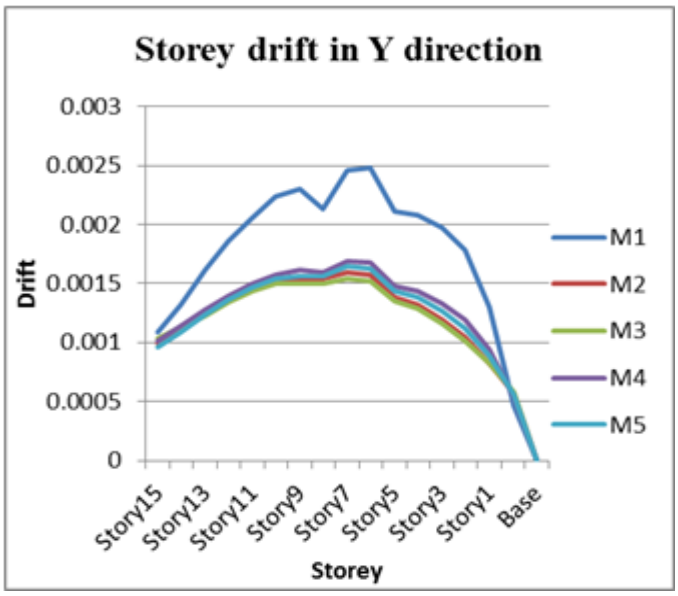

Figure 9: storey drift in X direction

Result of analysis for various models

IV. CONCLUSION

1. Steel Bracing is one of the advantageous concepts to be used in a high rise building to reduce lateral displacement and also to strengthen damage structure.
2. The displacement of the building decreases depending upon the different bracing system employed. About the whole of performance of X braced building better than other types of braced building.

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