seismic analysis of g+10 building with different types of bracing by using etabs software

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Abstract : In general the most suitable choices in improvement of steel frame against lateral loading is used steel bracing system. In this study, the seismic analysis of steel buildings with different types of bracings is studied. The bracing system used are X-bracings, V-bracings, ZX-bracings and inverted V-bracings compared with moment resisting frame. The bracings are provided along wall. The building is modeled and analyzed using ETABs software for 11 storey (G +10) building situated in Pune. The zone III as per 1893-2002 is selected for the study. Analysis is carried out by using response spectrum analysis. The effects of some parameter like displacement, base shear and storey drift influencing the seismic performance including type of bracing system is investigated.

IndexTerms **- seismic design, steel frames, bracing system, response spectrum analysis .**

I. INTRODUCTION

In seismically active zones structures are subjected to lateral earthquake forces in addition to bearing the primary gravity load. The performance of a structure during an earthquake depends on the intensity of the earthquake and the properties of the structure. In case of steel buildings, stiffness is more important than strength.

There are several technologies that could chosen such as dampers, shear wall, bracings etc. Among the techniques available, steel braces can be considered as one of the most efficient solution for seismic performance. There are various types of bracing like chevron braced frame (CBF), V braced (VBF), inverted V, X braced , K Braced , ZX braced , Zipper braced ,buckling restrained braces (BRB s) ,etc.

1.1 DESCRIPTION OF STRUCTURE UNDER STUDY

Three dimensional steel structures, used for commercial purposes, having 11 storeys are selected for seismic response computations .The sizes of beams and columns of different bracing patterns are the same as that of MRF. The same sizes of braces are assigned to different bracings. The height of each is 3.0 m.

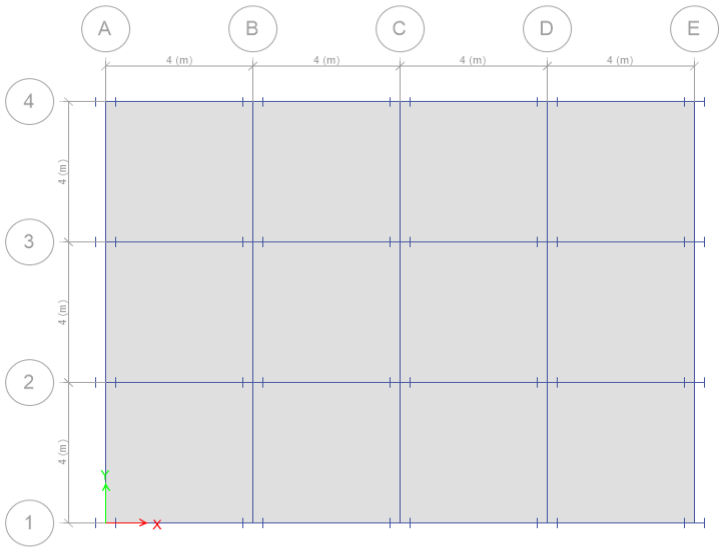

Fig.1.1. Floor plan of steel frame story

Dead load and live load are assumed to be 5 KN/m and 3 KN/m respectively. In addition the self weight of floor structure .As per IS875:1987(Part 3) basic wind speed for Pune region is 39 m/s.

1.2 Problem Statement

1. To find the appropriate bracing having best reversibility of structure after extreme loading.
2. To find reason and point of failure of structural elements (e.g. columns, beams) under seismic loading.

1.3 Objectives

1. To reduce the displacement of building due to lateral load.
2. .To reduce the effect of seismic energy on steel building.
3. To study effect of bracing on seismic performance.
4. Find the most effective bracing for earthquake zone.
5. To perform dynamic analysis of the building using response spectrum method.

II. RESEARCH METHODOLOGY

2.1 Selection of Earthquake Zone

Pune lies very close to the seismically active zone around koyna dam, about 100km south of the city and has been rated in zone III. This zone is classified as moderate damage risk zone. The IS code design zone factor of 0.16 for zone III. The importance factor and response reduction factor is 1.2 and 5 respectively for building.

2.2 No. of Storey

11 Storey steel building have been use in these study.

2.3 Role of ETABs

Extended Three-Dimensional Analysis of Building System (ETABs) is a kind of software generally used for structural analysis of multi-storey building or any structure. ETABs features are contain powerful graphical interface coupled with unmatched modelling, analytical, and design procedures, all integrated used in common data base.

2.4 Response spectrum method

Response spectrum analysis is method to estimate the structural response to short, non deterministic, transient, dynamic event.This concepts provide a conceptual basis for using response spectra based on single mass system for analyzing multi stoery buildings.We can use response spectra of single degree of freedom for computing the deflected shape, storey acceleration, forces and moment.

III. RESULTS AND DISCUSSION

3.1 Displacement

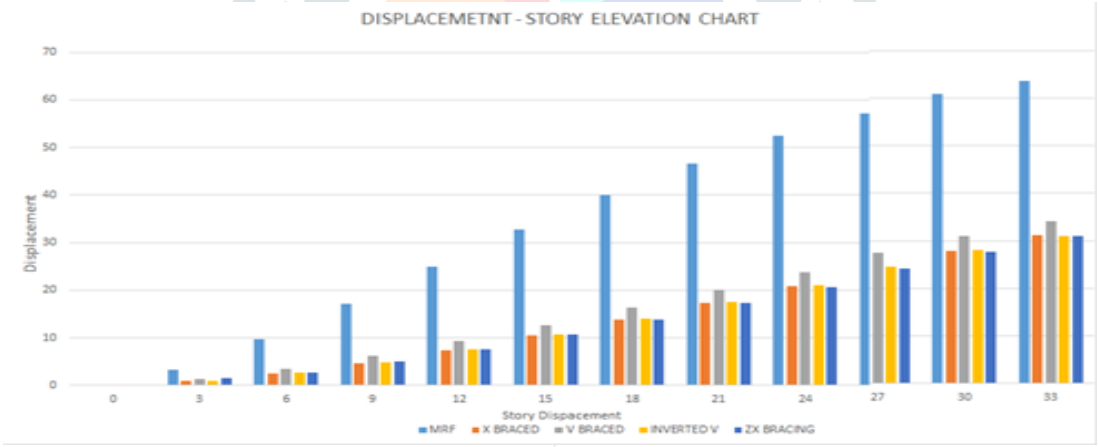

Fig.3.2 Displacement-storey elevation graph

In case of storey displacement, unbraced structure shows the maximum value. And the minimum displacement is observed for zx-bracing

3.2 Base shear

The base shear of the response spectrum analysis was calculated for braced and unbraced frames. It can be noticed that the base shear in unbraced frame were less than that of braced frames. From the Fig.3.2 we can conclude that maximum base shear is noticed in zx-bracing.

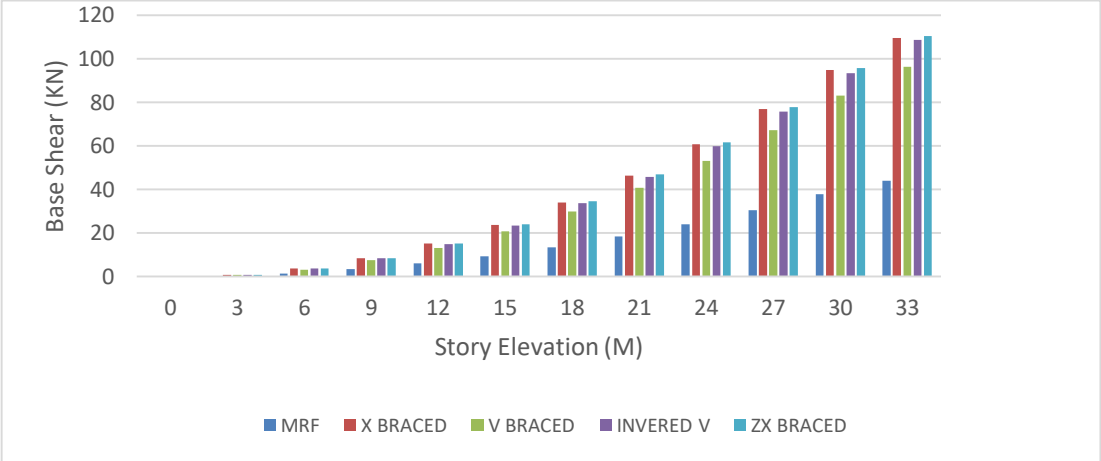

Fig.3.2.Base shear-storey elevation graph

3.3 Storey drift

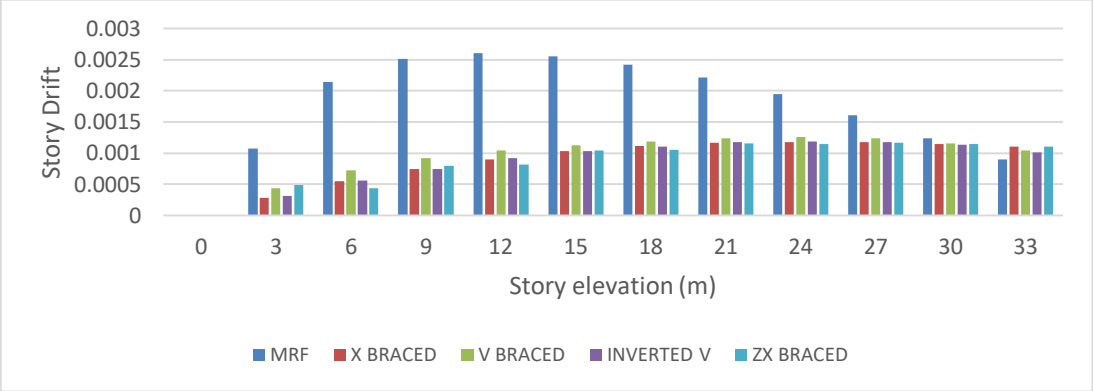

Fig.3.3.Storey drift-storey elevation graph

The distribution of inter storey drift ratio over building height become non uniform over building height increases. Inter storey drift ratio is higher in MRF building than other system for all lateral load cases. The inter storey drift for zx bracing system is lower compared to other types of bracings.

IV. CONCLUSION

In this paper, an attempt is made to assess the seismic behavior of steel frames by using bracing and unbracing systems.
The conclusion of this study can be summarized as follow:

1. It has been found that among all the structure, ZX braced structure is best option from structural point of view.
2. Bracing imparts better strength and stiffness to the structure.
3. More stiffer the frame lesser the storey drift.
4. For braced building the storey drift is getting low when it is compared to the unbraced building which show that the overall response from the structure decreases.

V. ACKNOWLEDGMENT

It gives us great pleasure in presenting the preliminary project report on ‘‘SEISMIC ANALYSIS OF G+10 BUILDING WITH DIFFERENT TYPES OF BRACING BY USING ETABs SOFTWARE’’

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