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Comparative Study of Various Types of Bracing used for Tall RCC Building

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ABSTRACT: Now bracing are most popular system. It is the best method for lateral load resisting systems and it will be the viable solution for enhancing earthquake resistance. It provides for minimizing the lateral deflection of buildings. In this study, the seismic analysis of RCC buildings with different types of bracings is studied. The bracing system used are X-bracings, V-bracings, inverted V-bracings and K-bracing compared with moment resisting frame by using same plan in both X and Y directions. The bracings are provided along vertical face. The building is modeled and analyzed using ETABS software for 15 story (G +12) building situated in Pune. The zone V as per 1893-2002 is selected for the study. The analysis is carried out by using response spectrum analysis. Results obtained by considering base shear, maximum storey drift, maximum storey displacement, storey overturning moment and time period.

KEYWORDS: Bracings, base shear, storey drift, maximum storey displacement, storey overturning moment & time period, ETABS software.

INTRODUCTION

Bracing is a structural member system commonly used in structures. It can resist lateral loads such as wind and earthquake load. The members in braced frame are generally made up of steel material. Bracing can work effectively both in tension and compression. The beams and columns carry vertical loads and bracing system carry lateral load. Bracing help to minimizing the beam and column dimension. Also reduce the cost. There are various types of bracing like x-bracing, v-bracing, inverted v-bracing, k-bracing, zx-bracing, knee bracing, diagonal bracing, zipper bracing, diagonal forward bracing and diagonal backward bracing. For the study purpose we have selected four types of bracing like x-bracing, v-bracing, inverted v-bracing and k bracing.

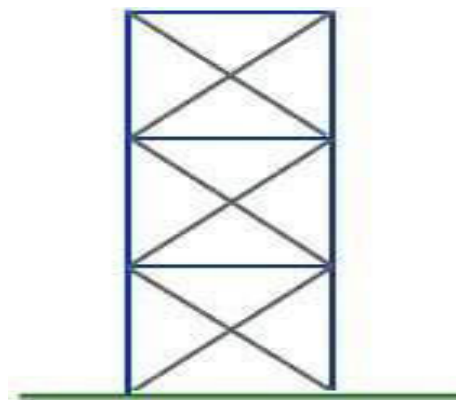


Fig:1.1 X-bracing

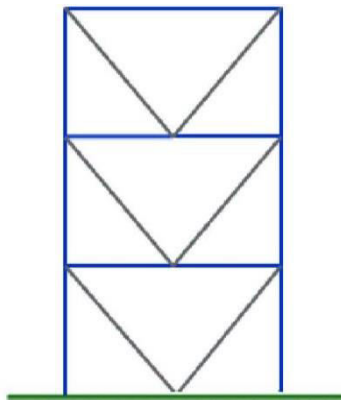


Fig:1.2 V-bracing

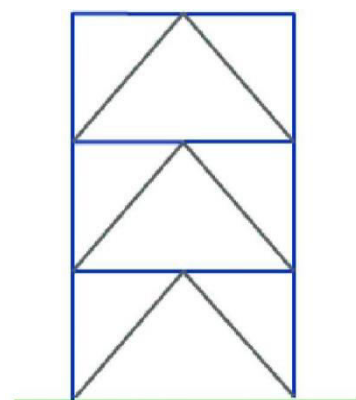


Fig:1.3 Inverted V-bracing

1.1 PROBLEM STATEMENT

Comparative Study Of Various Types Of Bracing Used For Multi-Storey RCC Building In Zone V.

1.2 OBJECTIVES

- 1) To Study Effect Of Various Types Of Bracing On Seismic Performance.
- 2) To Find Effective Bracing For A Building Located In Seismic Zone-V.
- 3) To Find Performance Of Building In The Form Of Storey Drift, Displacement, Base Shear, Time Period.

II. METHODOLOGY

2.1 Research methodology

According to objectives defined Comparative study of multistory RCC building without bracing and with different types of bracings to will be taken i.e x bracing, v bracing, inverted v bracing, and k bracing of same plan and seismic analysis will be carried out. In this project, modeling and analysis are carried for 15 Stories (G+12) Building and analysis is done by using ETABS software according to Indian standard codes. Design and computing results like time period, base shear. There are five models, model 1 consist without bracing, model 2 consist a X bracing, model 3 consist a V bracing, model 4 consist a inverted V bracing, model 5 consist K bracing. Each model done by ETABS Software.

2.2 Model description

In a present study there are five models, model 1 consist without bracing, model 2 consist a X bracing, model 3 consist a V bracing, model 4 consist a inverted V bracing, model 5 consist K bracing. The modeling and the analysis of building frames carried out using ETABS software using response spectrum analysis.

In this present study 5 models are studied as described below: -

1. model 1 consist without bracing in zone V
2. model 2 consist a X bracing in zone V
3. model 3 consist a V bracing in zone V
4. model 4 consist a inverted V bracing in zone V
5. model 5 consist K bracing in zone V

2.3 Description of building:

Table 2.1 Description of building

Number of story	15 (P+G+12+HR)
Floor height	3m
Slab thickness	0.125 m
Live load	2 kN/m ² at each floor
Floor finish load	1.5 kN/m ²
Concrete grade	M30
Steel grade	Fe500
Beam details	As per design
Column details	As per design
Bracing details	ISA 150X150X12

2.4 Earthquake parameters:

Table 2.2 Earthquake parameters

Type of frame	MRF
Seismic zone (Z)	V
Response reduction factor (R)	5
Importance factor (I)	1

Figure:

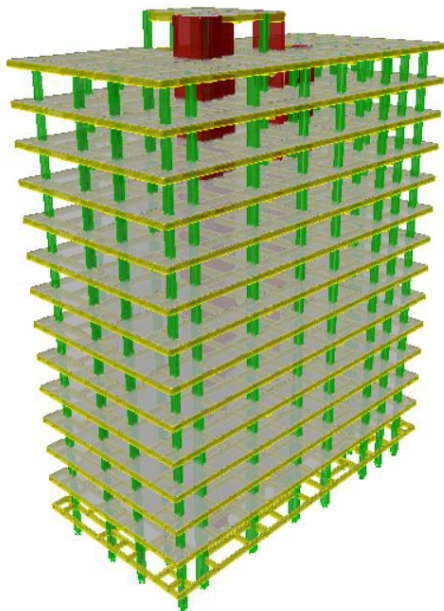


Fig. 2.1 3D rendering view of building without bracing in ETABS

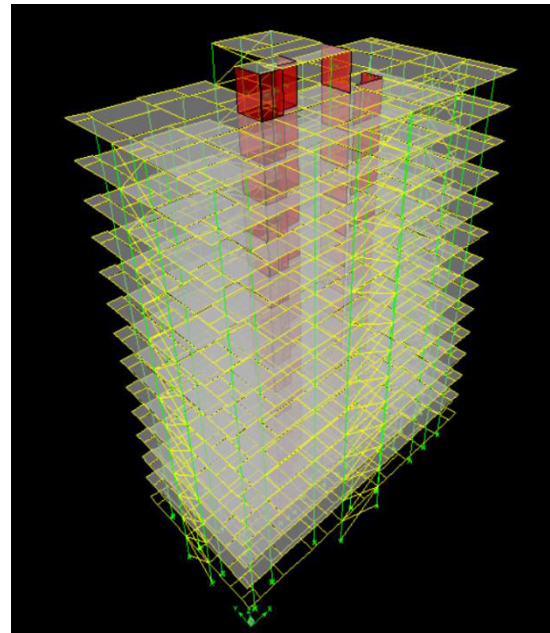


Fig. 2.2 Elevation view of building with X bracing in ETABS

Model-1: Conventional G+12 R.C.C. building without any bracing is considered for comparison purpose. **Model 2-:** Conventional G+12 R.C.C. building with X bracing is considered in this model.

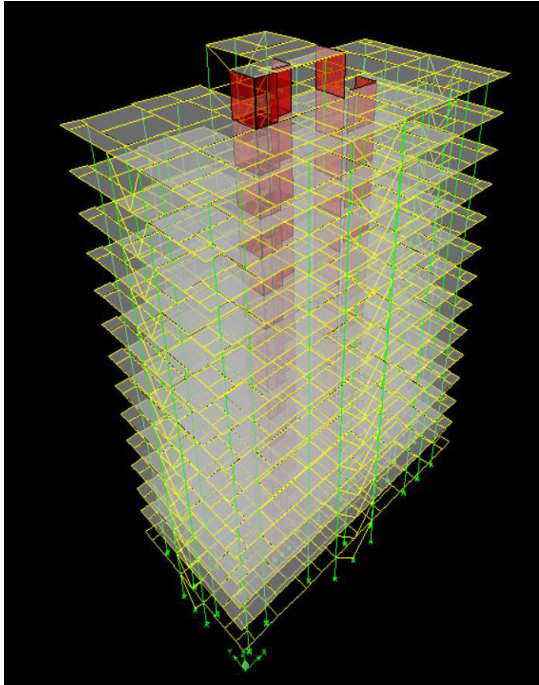


Fig. 2.3 Elevation view of building with V bracing in ETABS

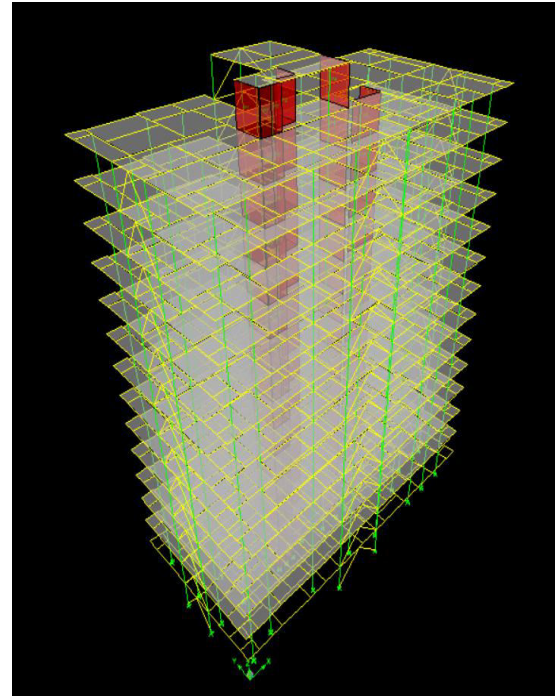


Fig. 2.4 Elevation view of building with inverted V bracing in ETABS

Model 3: Conventional G+12 R.C.C. building with V bracing is considered for comparison purpose. Inverted V bracing is considered in this model.

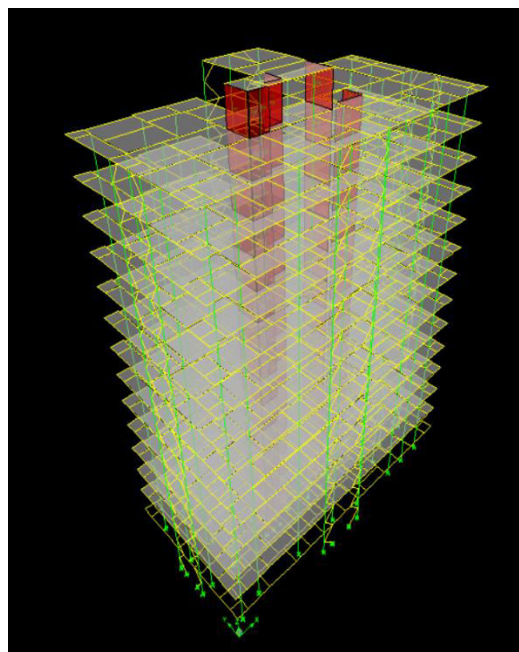


Fig. 2.5 Elevation view of building with K bracing in ETABS

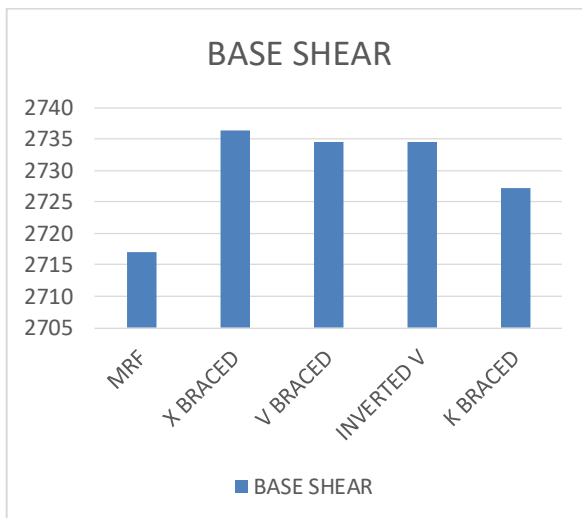
Model 5:- Conventional G+12 R.C.C. building with K bracing is considered in this model.

III. RESULTS AND DISCUSSION

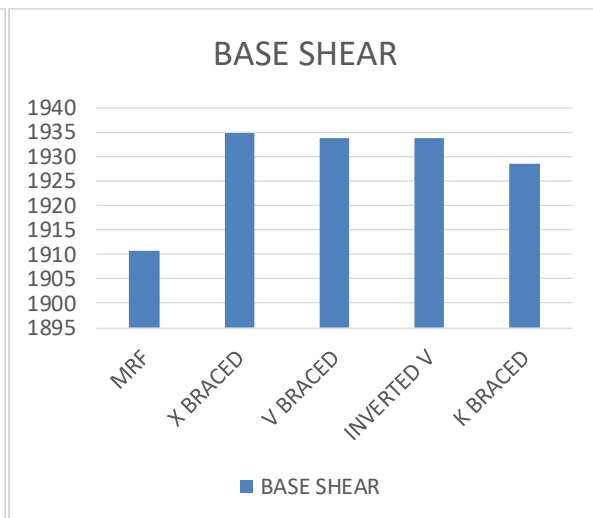
3.1 Results:

Comparative study of various types of bracing used for multi-storey RCC building for both with bracing and without bracing building is carried out for the analysis. The without bracing building analysed and with bracing buildings models analysed with bracing frame and by applying different types of bracings, the results are tabulated such as, base shear, maximum storey drift, maximum storey displacement, storey overturning moments and time period is noted.

3.1.1 Base shear results

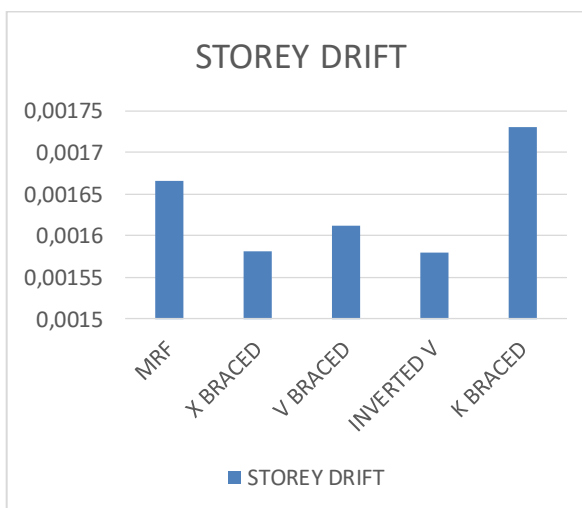


Graph: 3.1 Base shear for EQX

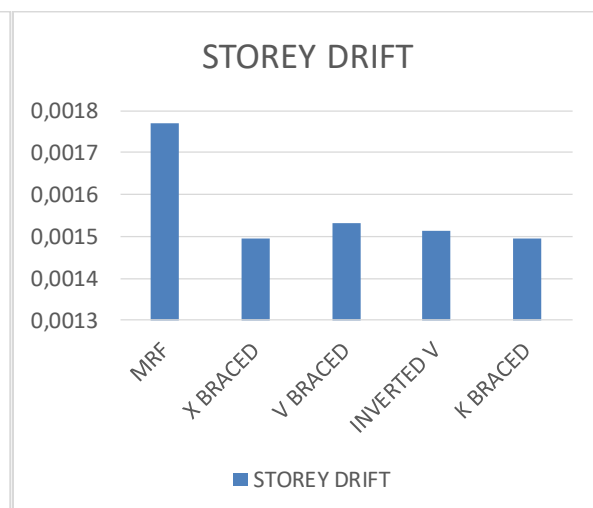


Graph: 3.2 Base shear for EQY

3.1.2 Storey drift results

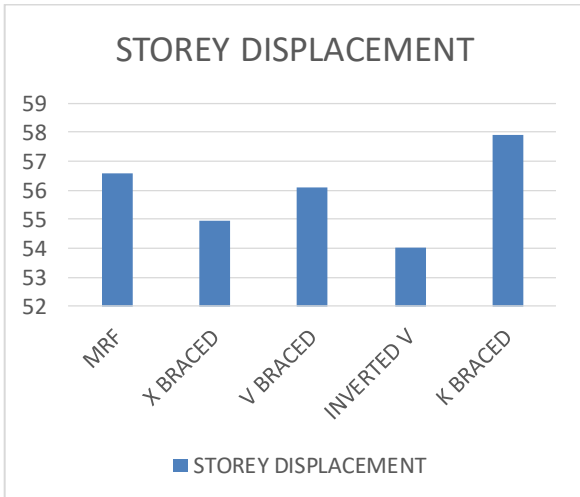


Graph: 3.3 Maximum storey drift for spectrum 1

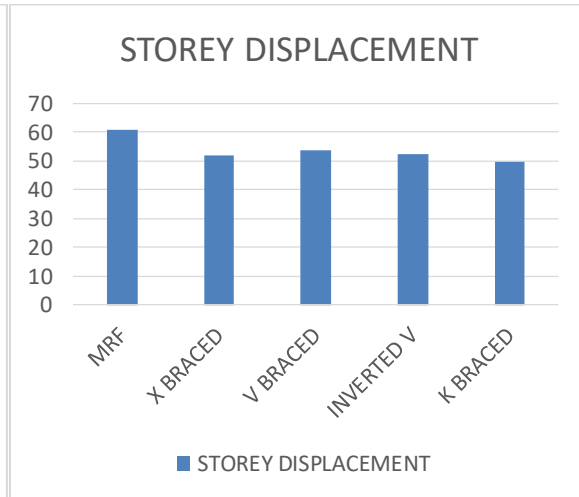


Graph: 3.4 Maximum storey drift for spectrum 2

3.1.3 Storey displacement results

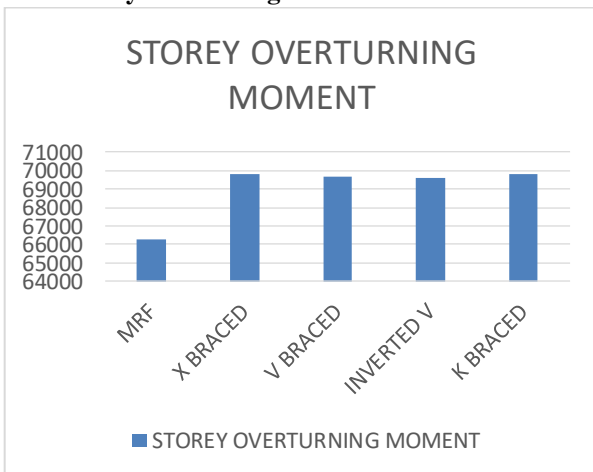


Graph: 3.5 Maxstorey displacement for spectrum 1

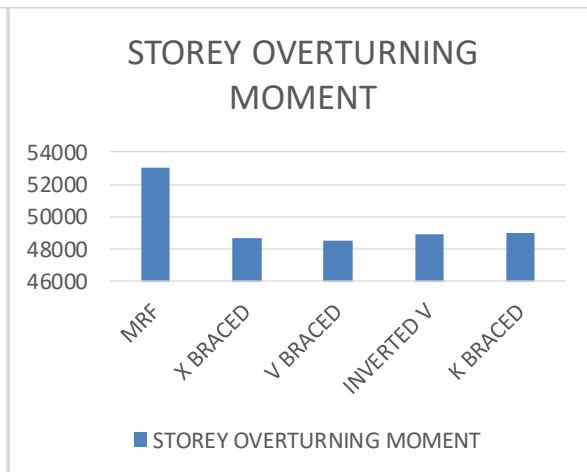


Graph: 3.6 Max storey displacement for spectrum 2

3.1.4 Storey overturning moment results

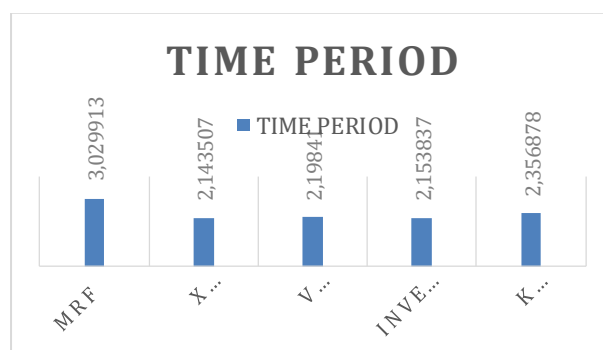


Graph: 3.7 Storey overturning moment for spectrum 1



Graph: 3.8 Storey overturning moment for spectrum 2

3.1.5 Time period results



Graph: 3.9 Time period

IV. CONCLUSION

A numerical study was conducted to assess the behaviour of different type of bracing and unbrace system for steel frame using response spectrum analysis. The bracing system are X- bracing, V-bracing, Inverted V- bracing, K- bracing. The conclusion of this study can be summarized as follows.

- It has been found that among all the structure, X braced structure is best option from structural point of view.
- There is not much difference in base shear values as there is very little change in seismic weight of the structure with bracing.
- Bracing imparts better strength and stiffness to the structure.
- More stiffer the frame lesser the storey drift and is minimum for x bracing system.
- Braced systems has reduced overturning moments as compared to unbraced system.
- The bracing in building reduces the storey displacement compared to unbraced frame.
- Braced systems has reduced time period values as compared to unbraced systems and minimum for X bracing.

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