

# Seismic Retrofitting Analysis by Using Drift Displacement\*

Doke S.<sup>1</sup>, Dongare V.<sup>2</sup>, Hande A.<sup>3</sup>, Inamdar S.<sup>4</sup>

<sup>1</sup>UG Scholar, Department of Civil Engineering, College of Engg, Kuran, Savitribai Phule Pune University, Pune, India

*Sagardoke7@gmail.com*<sup>1</sup>  
*vaibhavdongare1994@gmail.com*<sup>2</sup>  
*Akashhande24@gmail.com*<sup>3</sup>  
*shafikinamdar02@gmail.com*<sup>4</sup>

Prof. Gayake P.R.<sup>5</sup>

<sup>2</sup>UG Guide, Jaihind College of Engg, Kuran, Pune, India.  
*prasadcivilbe@gmail.com*<sup>5</sup>

**Abstract**— Many existing reinforced concrete buildings need to retrofit to overcome the deficiencies to resist seismic load. By using E TAB software as per IS 1893:2016 (part-1). A G+10 storey building is analysis for seismic zone III. Retrofitting is most effective method to reduced risk for building. . In present study aim to evaluate the different types of bracing system for 10 storey RCC building .The models were compared for different points within building such as maximum storey lateral displacement , Storey shear, storey drift and lateral load resisting capacity of building. Bracings systems are one of the lateral load resisting system which has got structural importance specially in RC concrete buildings. Different bracing systems are efficient enough for seismic responses. Bracing is very effective strengthening technique.

**Index Terms** - Earthquake ,Seismic performance, ETABS, Retrofitting, Strengthening

## I. INTRODUCTION

India is one of the most earthquake prone countries in the world and has experienced several major or moderate earthquakes during the last 15 years. Seismic retrofitting of constructions vulnerable to earthquakes is a current problem of great political and social relevance. about 50-60% area of country is seismically active zone. This creates horizontal forces in the structures, which is termed as seismic forces. In most case, where in the original design has provided for the vertical extension, the existing structure is found adequate for the gravity loads (dead or lives). This is particularly so because an age factor of 1.2 (as stipulated in IS: 456:2000) can be applied to the concrete strength for columns of the existing building. but, many buildings are found inadequate to carry the design seismic load not only with the additional storeys, but also with the existing storeys. Some of the reasons for this are described subsequently. Also, the building already damaged in an earthquake, need to be repair and strengthening. then, it is not sufficient to just repair.

## II. literature Review

Shachindra Kumar Chadhar<sup>1</sup>, Dr. Abhay Sharma<sup>2</sup>  
 (Volume: 02 Issue: 05 | Aug-2015 )

Steel bracing system is one of the effective measures for resisting the horizontal forces like seismic and wind forces in reinforced concrete multistory buildings. Bracing member's are subjected to tension and compression; subsequently they are provided to take these forces.

Steel bracing system shows the efficient and economical measures for RC multistory buildings located in high seismic regions.

2 RUPALI MOHAN CHAVAN 1,M.Tech Student ,  
 Mr.P.Rukesh 2, Assistant Professor (Volume.3, Issue.8,  
 August.2017)

Retrofitting is the process of modifying something after it has been manufactured, like; Power plant retrofit, improving power plant efficiency / increasing output / reducing emissions, Home energy retrofit, the improving of existing buildings with energy efficiency equipment, Seismic retrofit, the process of strengthening existing buildings in order to make them earthquake resistant.

III. METHODOLOGY

Type of frame	RCC Frame
RCC Building	G+10 Storey Building
Storey Height	3.2m
Base storey height	1m
Beam size	250mmX 300mm
Column size	250mmX 500mm
Thickness of slab	150mm
Steel bracing used	ISA100X100X10mm
Live load	4 KN/m <sup>2</sup>
Floor finish	1 KN/m <sup>2</sup>
Compressive strength of concrete	25 N/mm <sup>2</sup>
Yield strength of steel	415 N/mm <sup>2</sup>
Seismic zone	III
Zone factor	0.16
Sub-soil type	Medium
Importance factor	1
Response reduction factor	5
Method for Analysis	Linear static method

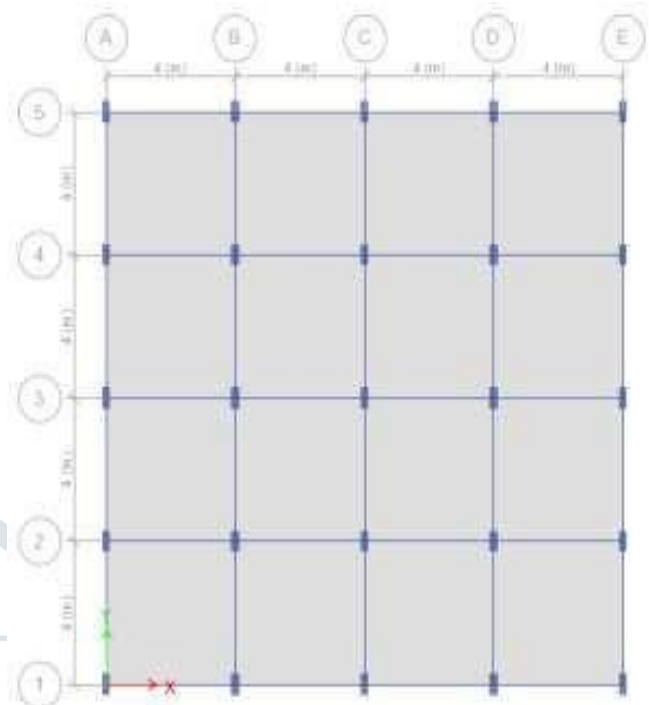


Fig -1: Plan of Building

1. MODELLING IN ETABS

Seismic analysis is carried out on building models using ETABS 2016 Software with M25 grade of concrete.

Nos. of bays in X direction=5

Nos. of bays in Y direction=5

Spacing of grid in X & Y direction = 5m

The models with various bracing installation are analysis in ETABS 2016. Plan, elevation and 3D modeling of structures are given below:

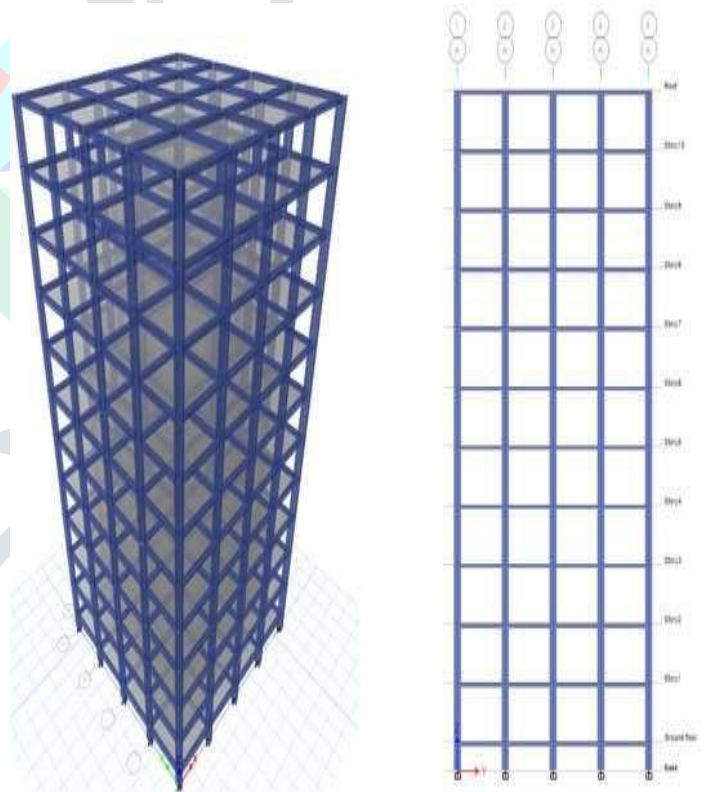


Fig2:-Model of Un-braced (G+10) storey structure.

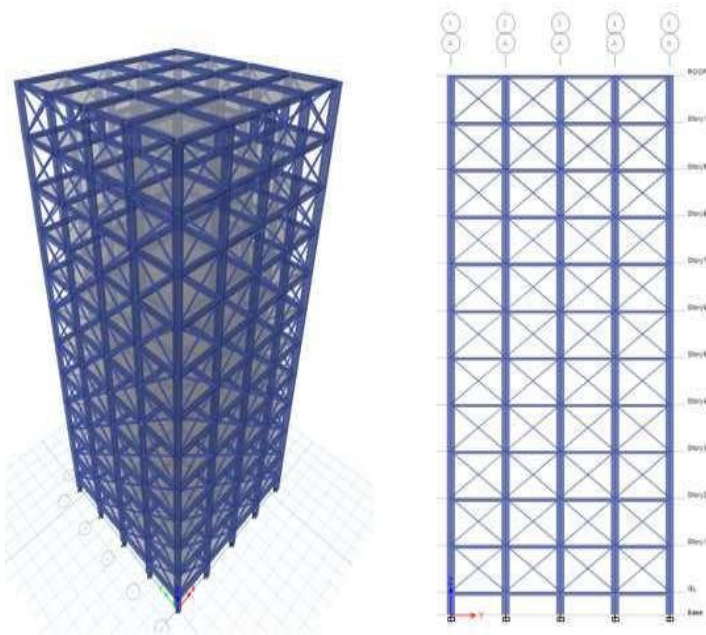


Fig 3:- Models of (G+10) storey structure with X type bracing

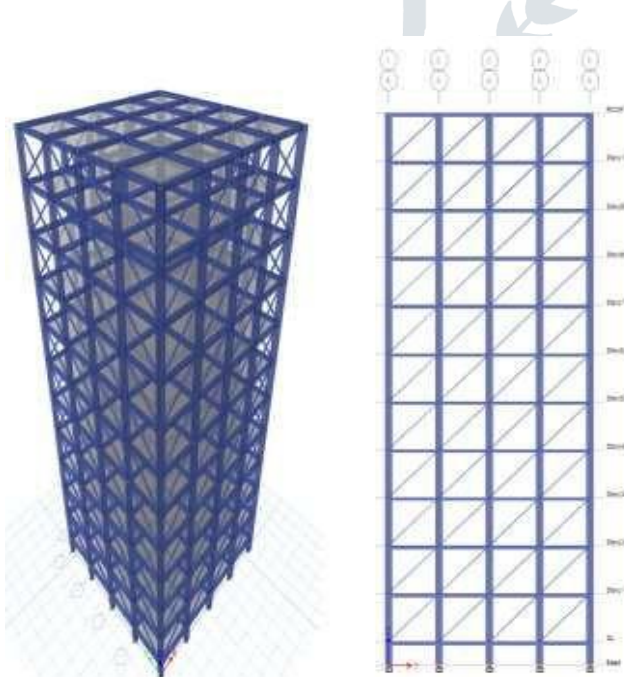
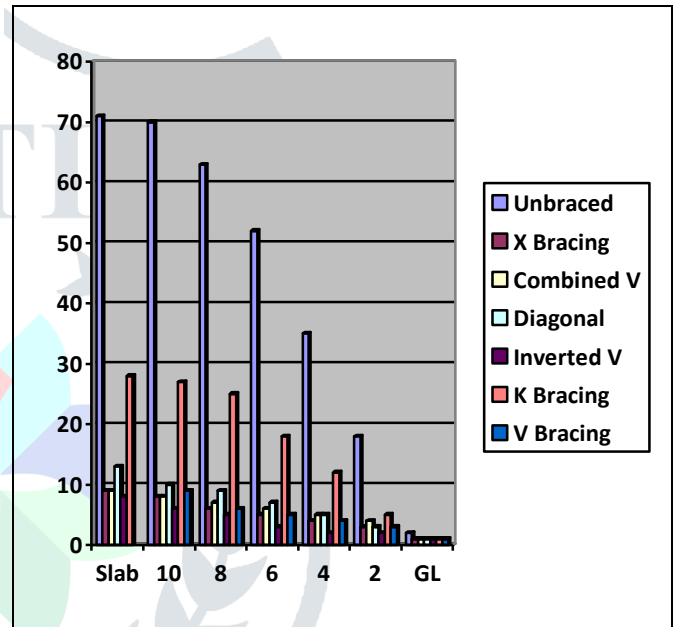


Fig4:- Model of (G+10) storey structure with Diagonal bracing

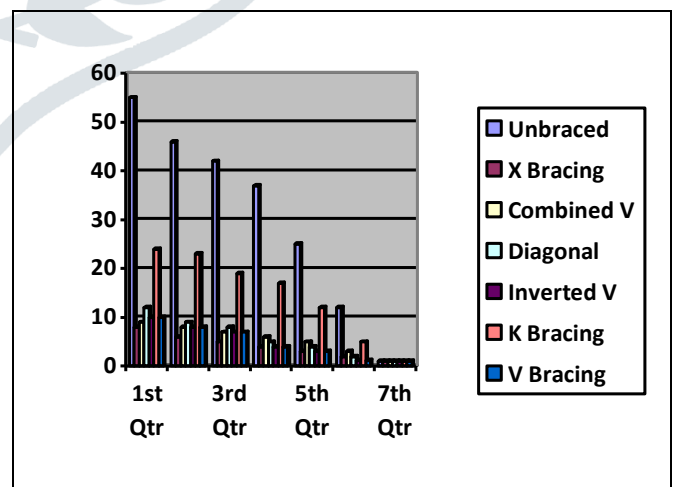
IV. RESULTS AND ANALYSIS

1.1 Lateral Displacement

It is observed from that the lateral displacement is reduced to a huge extent for X type of bracing system, while the displacement is maximum for the un-braced system. The displacement is reduced sequentially for bracing type inverted V, combine V type, diagonal bracing and K bracing. These patterns are observed due to increased stiffness provided by the respective bracings. Top roof displacement for the system with 'X' type bracing is reduced by 63.99% in X direction as compared to that of un-braced system.



Lateral Displacement in X direction (mm)



Lateral Displacement in Y direction (mm)

Storey Drift

It can be observed from the graph that the story drifts are reduced to largest extent for X type of bracing systems, while these are maximum for the system without bracing.



Chart(3) :- Storey Drift in X direction

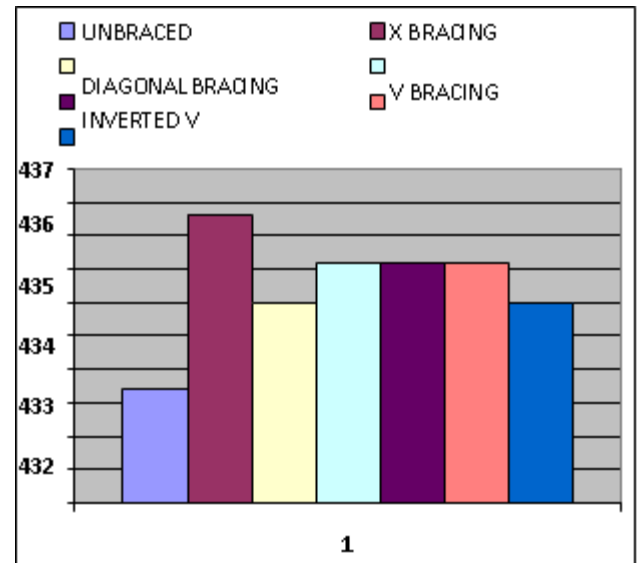


Chart 5: Base shear in both directions

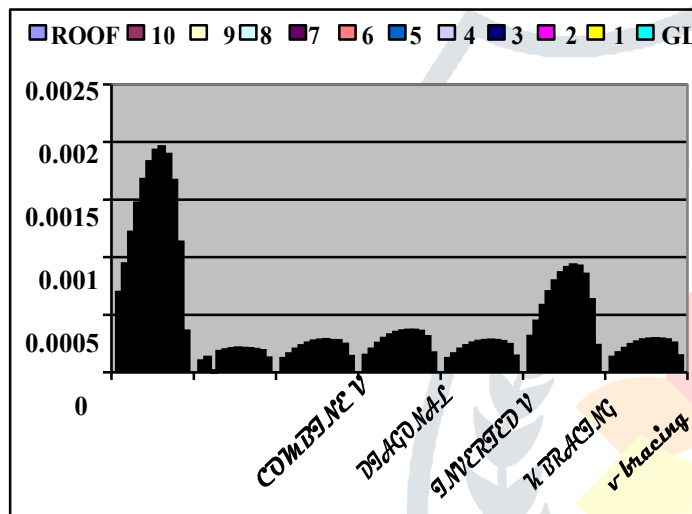


Chart (4): Storey drift in Y direction

**1.1 Base Shear**

It is observed that, from the analysis result that the base shear is maximum for X type bracing systems, while it is optimum for the un-braced system. The base shear are rising in sequentially in K type of bracing, diagonal bracing, V type bracing, combined V type of bracing, inverted V type of bracing and X type of bracing.

**V. CONCLUSIONS**

The analysis of the { G+10 } storey building with different types of structural system, it has been conclude that:-

The displacement of the structure reduced after the use of bracing technique.

- The maximum reduction in the lateral displacement occurs after the application of X type bracing system which gives the value of 6.8 mm in X direction and 5.9478 mm in Y direction while it is 68.2 mm, 50 mm in X and Y direction respectively in case of un-braced structure.
- Lateral displacement and storey drifts are optimum for inverted V braced frame as compared to V braced frame.
- The application of X type of bracing system is better than the other specified bracing technique. Steel bracings can be used to strengthen the existing structure. It is conclude that arrangement of bracing technique has considerable effect on seismic performance of the structure.
- In comparison of X bracing system and un-braced structure, storey drift is reduced to large extent for X type of bracing system. After analysis in ETABS it gives the value 0.00014 for 'X' bracing and 0.00071 for Un-braced structure. The concept of using steel bracing is one of the advantageous technique which can be used to

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