International Journal of Research in Engineering and Science (IJRES)
ISSN (Online): 2320-9364, ISSN (Print): 2320-9356
www.ijres.org Volume 9 Issue 9 ǁ 2021 ǁ PP. 67-74

Comparative Study of Steel Structure using different types of Bracing

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Abstract –
Now a days, bracings 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 is provides for minimizing the lateral deflection of buildings. In the present study G+15 storeys is analyzed for Z-II by considering soil type II. The analysis carried out to assess the structural performance under earthquake ground motions. In this study there are different types of bracing i.e. X bracing, V bracing, K bracing and Diagonal forward bracing and without bracing by using same plan in both X & Z Directions. Results are obtained by considering Storey Displacement, Base Shear, Time period for equivalent static analysis and response spectrum analysis.A braced frame is designed primarily to resist wind and earthquake forces in and a structural system. Bracings are provided to increase stiffness and stability of the structure under lateral loading and also to reduce lateral displacement significantly.
Key Words:*Storey displacement, base shear, time period, STADD PRO.*

Date of Submission: 13-09-2021 Date of acceptance: 28-09-2021

I. INTRODUCTION

Bracing is a structural member which can resist lateral loading. It is made up of Steel and RCC material which enables to resist lateral load. Bracing frames are classified in to X bracing, V bracing, Inverted V bracing, Diagonal forward bracing, Diagonal backward bracing. Bracings help to minimize the beam and column dimension. It also reduces the cost. The provision of bracings enhances stiffness and strength. Bracing which decreases the damage to the structure by decreasing the sway in lateral. Bracing which shows the good performance, if it is properly detailed and designed. Bracing which carries forces due to earthquake, overturning effect. In tall buildings there will be a chances of decrease in the displacement and collapsible chances due to more number of stories. Bracing are effective in minimizing the forces of earthquake and wind.A braced frame is designed primarily to resist wind and earthquake forces in and a structural system. Bracings are provided to increase stiffness and stability of the structure under lateral loading and also to reduce lateral displacement significantly.

SCOPE OF STUDY

Buildings with same types of the zonal condition and for the same category can be adopted. Without bracing and with bracing i.e. X bracing, V bracing, bracing and Diagonal forward bracing can be adopted. It shows the behaviour of the different bracings when it is placed at the alternative layer locations. Analysis of response such as storey displacement, Base shear, and time period is carried out using the STADD PRO software.

Aim and Scope of the Study

- Modelling of the structure using STADD PRO V8 software
- The major goal of this thesis is to look into the impact of bracing systems on steel structure design. The outcomes of different structures with different bracing systems are evaluated.

1. NARRATIVE OF MODEL The present work involves analysis of without bracing and with bracing i.e. X bracing, V bracing, K bracing and Diagonal forward bracing of same plan. In this project, modeling and analysis are carried for G+15 stories modeling and analysis is done using STADD PRO software. There are five models. Model 1 consist a without bracing, model 2 consists an X bracing, Model 3 consists a V bracing,model 4 consists a Diagonal forward bracing and model 5 consists a K bracing. The dimension of all models is of bay length 6m x 8m. Each model is done by STADD PRO.

Model Description

A rectangular building considered for analysis is symmetric in plan and elevation. The plan dimensions of the building to be modelled are 42m × 24m.

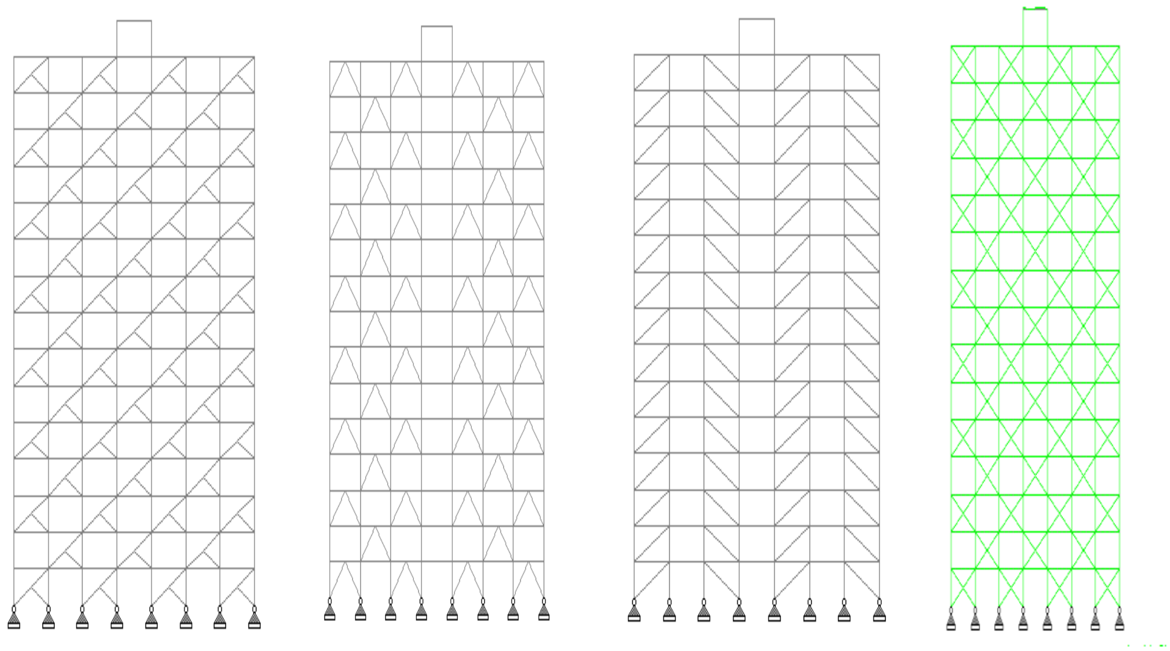
Title	**Specifications**
PlantSize	42m ×24m
Floortheight	3.35 m
Beamtsizes	ISMB600
Column sizes	ISMB600
Slabtthickness	150 mm
Live load	4 kN/m²
Floortfinish	1.5 kN/m²

1.Dead**t**load**t**asper**t**IS:875**t**(PartI)-1987
i) Self**t**weight**t**of**t**slab (150 mm**t**thick) –**t**3.125 kN/m2
ii) Loading**t**due**t**to**t**Floor**t**Finishes -**t**1.50 kN/m2

2. From**t**masonry**t**walls – 8.1**t**kN/m 3.

3. Live**t**load**t**as**t**per IS: 875**t** (Part-II)-1987
i) Live**t**load**t**on**t**floor**t**– 4.00 kN/m2
ii) Live**t**load**t**on**t**roof - 1.50 kN/m2

4. Earthquake**t**load**t** IS: 1893-2016
i) **t**Zone**t**factor - 0.16
ii) **t**Soil type - II
iii) **t**Importance factor - 1



Elevation View of K, V, diagonal and X type of bracing.

II. Results

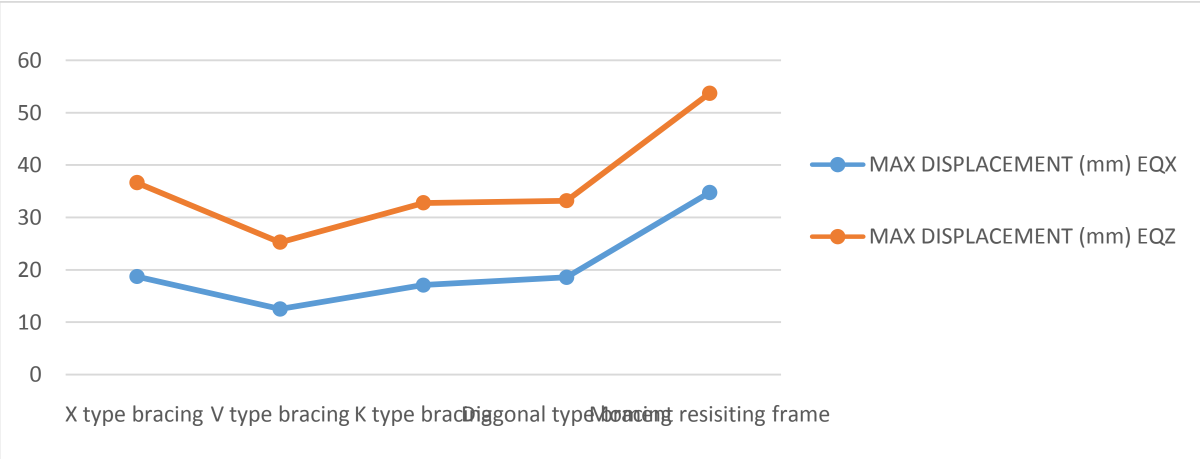


Figure - Graph of displacement variation

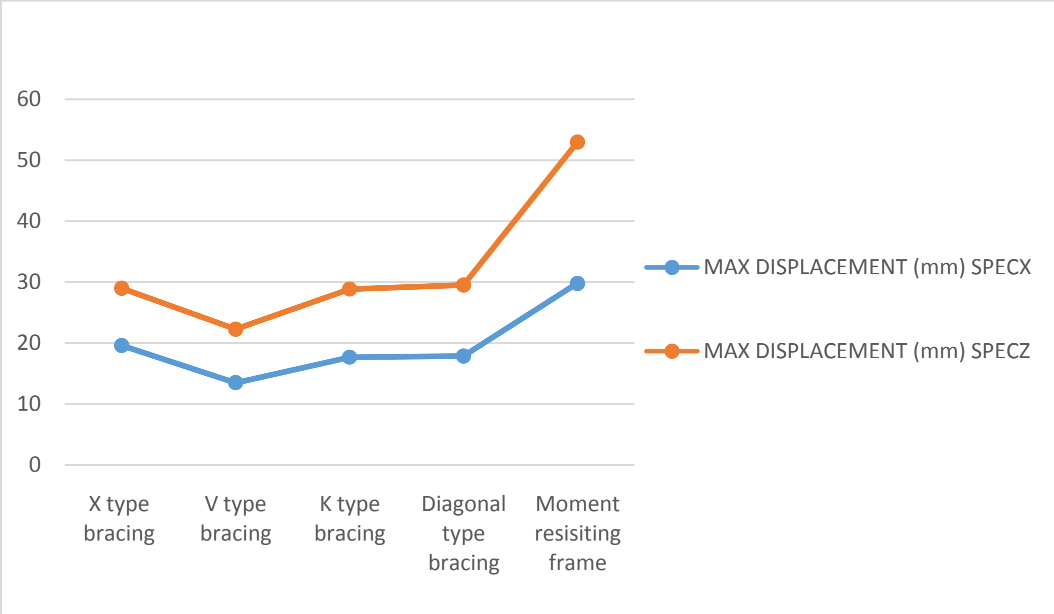
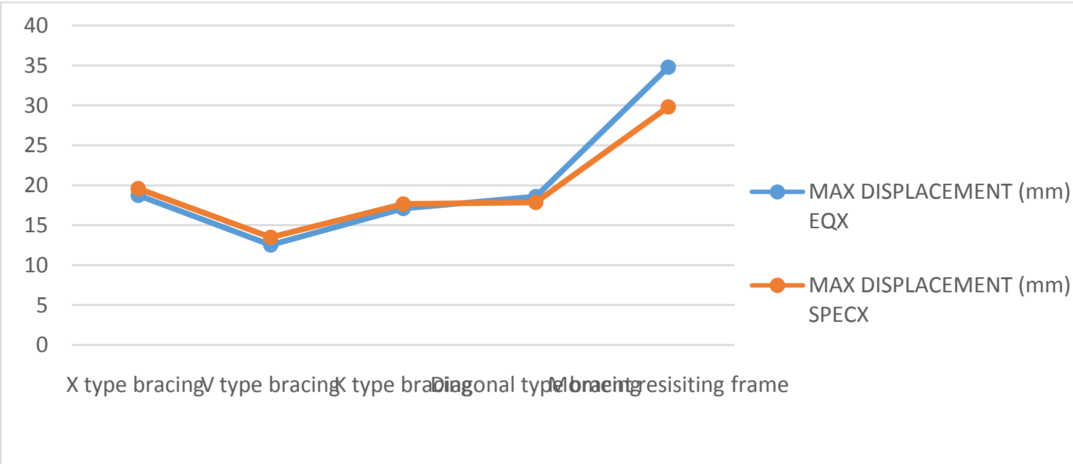


Figure- Graph of displacement variation



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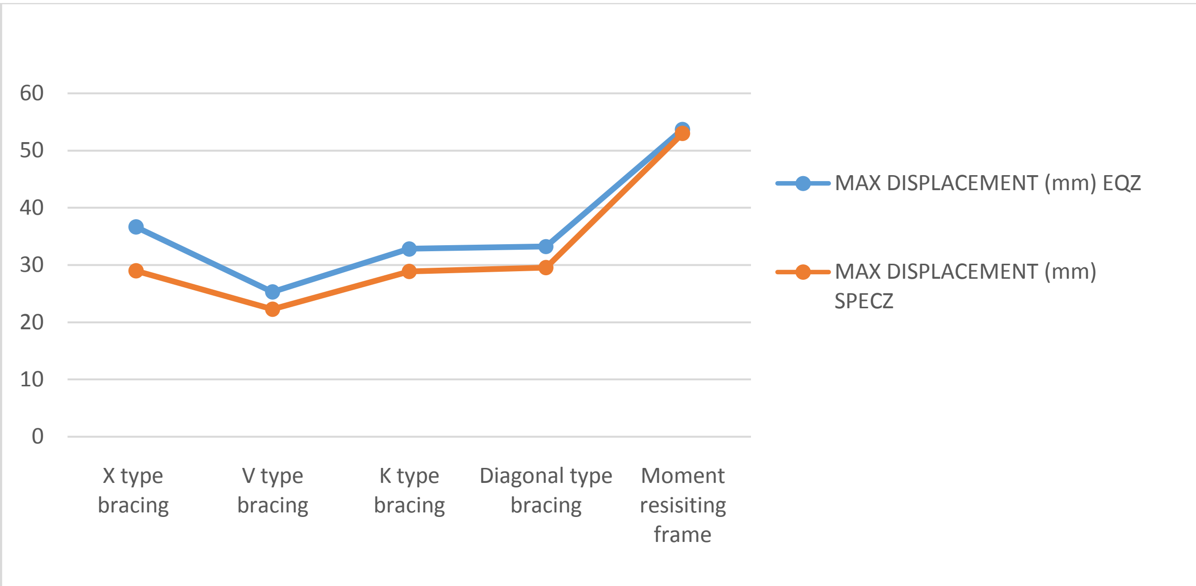

Figure -Graph of displacement variation

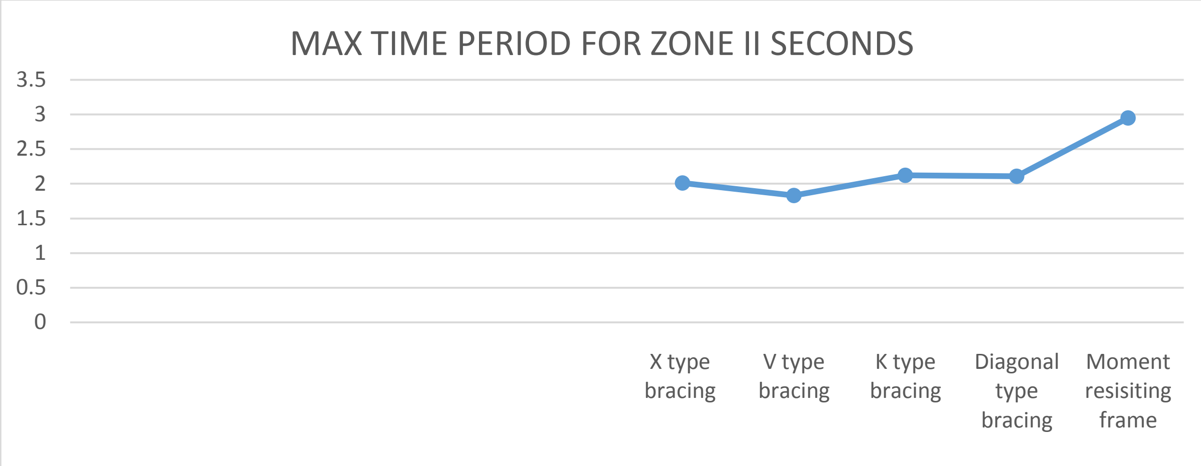

Figure- Graphtof variationtinttimetperiod.

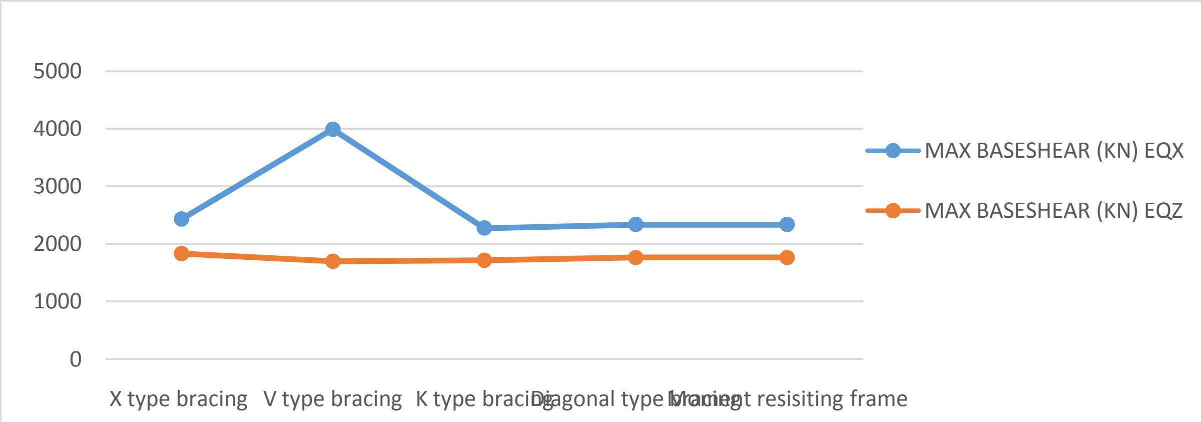

Figure - Graph of base shear variation

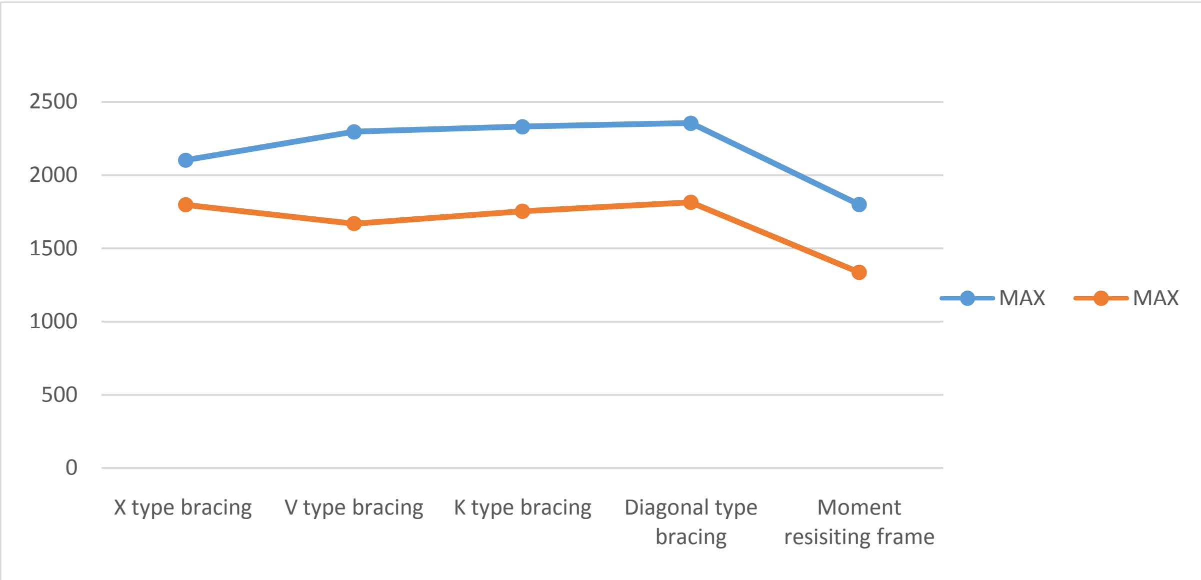

Figure - Graph of base shear variation

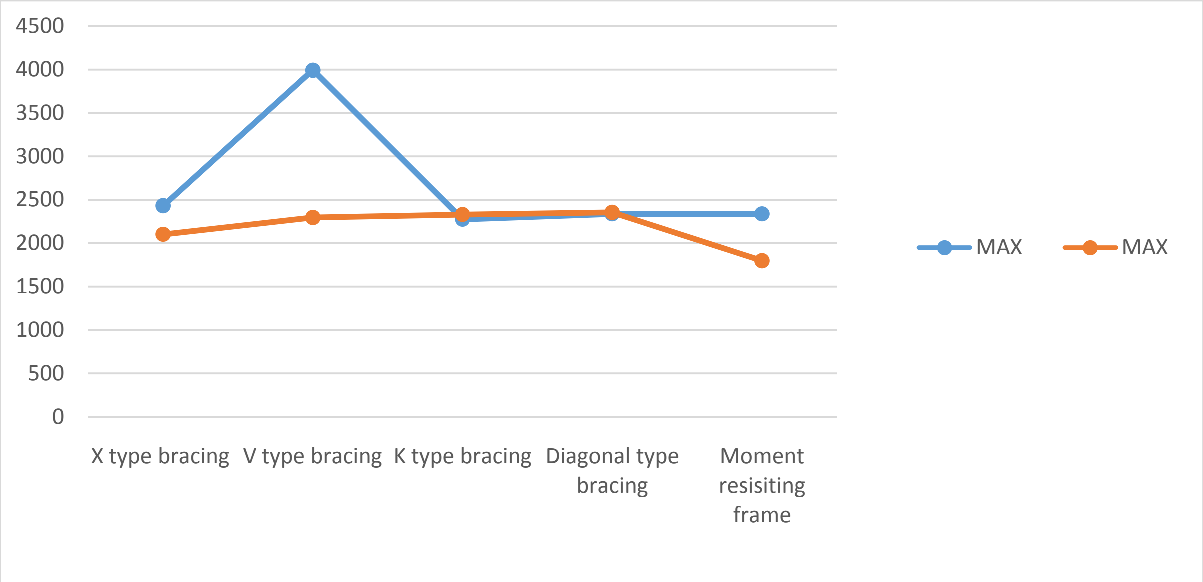

Figure - Graph of base shear variation

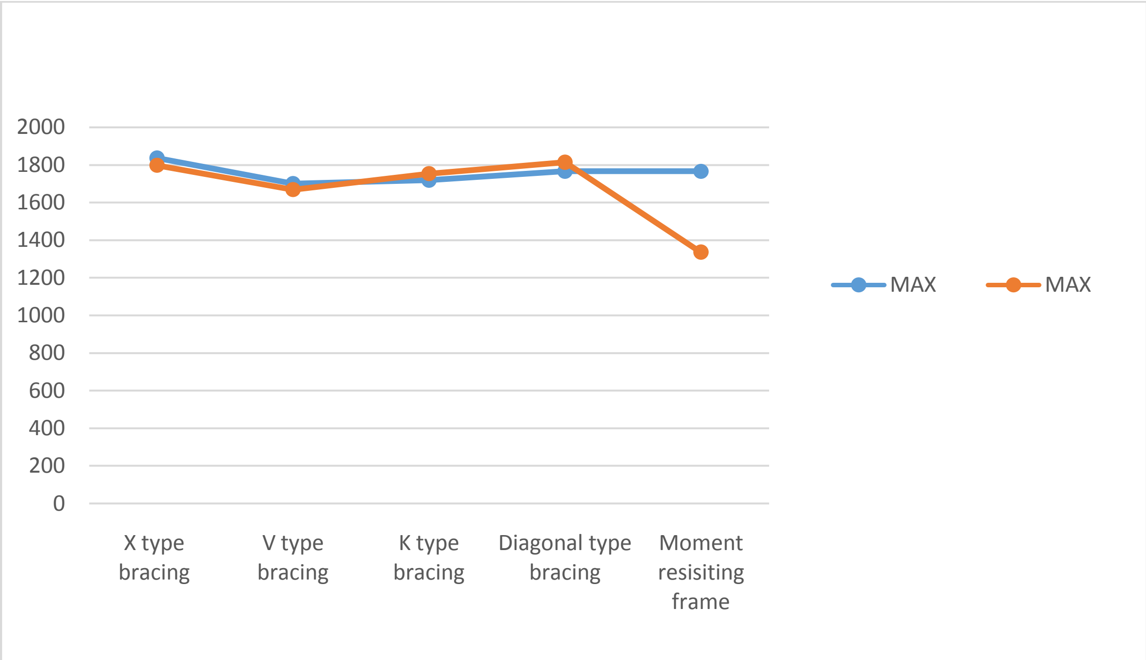

Figure - Graph of base shear variation

III. Result and Discussion

A. Displacement

1. Along X and Z direction

- Maximum displacement in Xttype bracing, tV type bracing, tK type bracing, and Diagonal type of bracing, moment resisting frame decreased along X direction by 4.38%, 7.12%, 3.22%, compared to Z direction, for static analysis.
- Maximum displacement in Diagonal type of bracing, moment resisting frame increased along X direction by 3.99%, 14.33%, compared to Z direction, for static analysis.
- Maximum displacement in X type bracing, Non regular typetbracing, K type bracing, tand Diagonal type of bracing,moment resisting frame decreased along X direction by 32.37%, 39.41%, 38.79%, 39.49%,43.744% compared to Z direction, for response spectrum analysis.
- For statics analysis along x direction maximum displacement for in Xttype bracing, V bracing, K type bracing, decreased along X direction by 4.38%, 7.12%, 3.22%, and
- Diagonal type of bracing,moment resisting frame is increased by 3.99% ,14.33% compared to Z direction for response spectrum analysis
- For statics analysis along Z direction maximum displacement for in Xttype bracing, V typetbracing, Kttype bracing,Diagonal type of bracing, moment resisting frame decreased along Z direction by 32.37%, 39.41%, 38.73%, 43.76% compared to Z direction for response spectrum analysis

B. Timetperiod

The Model with V type of bracing has lowered the maximum amount of time period, as shown in the graphs and tables of time period in the results section.It istnotedtthat intime period of Model with V type of bracing reduced by about 9.03%, 13.74%, 13.13%, 36.90% compared to X type bracing, K type bracing, Diagonal type bracing and moment resisting frame.

C. Base shear

2. Along X and Z direction

- Maximum base shear in Xttype bracing, tV type bracing, K type bracing, and Diagonal type of bracing and moment resisting frame increased along X direction by 24.49%, 57.44%, 24.48%, 24.48%,24.48% compared to Z direction, for static analysis.
- Maximum base shear in X typetbracing, Non regular type bracing, K type bracing, and Diagonal type of bracing and moment resisting frame increased along X direction by 14.45%, 27.28%, 24.73%, 22.92%, 25.73% compared to Z direction, for response spectrum analysis.
- For statics analysis along X direction maximum base shear for in X type bracing, V type bracing, and moment resisting frame increased along X direction by 13.55%, 42.52%, 23.07%, and K type bracing and diagonal type of bracing is decreased along X direction by 2.34%, 0.71% compared to Z direction for response spectrum analysis .
- For statics analysis along Z direction maximum base shear for in X type bracing, V type bracing, and moment resisting frame increased along X direction by 2.06%, 1.79%, 24.34%, and K type bracing and diagonal type of bracing is decreased along Z direction by 2.02%, 2.72% compared to Z direction for response spectrum analysis
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IV. Conclusions

By considering the all models with different types of bracings and theirtbehaviourtintdynamic earthquakeloading. Its concludedtthattwith V type of bracing givestthetmost suitable results.

The resultsof thisstudy showthat adding braced frameto steeltmomenttframetbuildingtis importanttttotreduce displacement when compared to other types of bracing.

In comparison to the others, V type and cross bracing offer the strongest resistance to lateral drift; nevertheless, cross bracing is more expensive due to the additional joints. Furthermore, V-bracing has been shown to be more adaptable to apertures and service channels. As a result, the chevron form is the best sort of bracing. Braced steel frames experience more base shear compared to unbraced frames. This is as result of the increased seismic weight of the structure contributed by the bracing members. Base shear increases in the order: Cross, diagonal, unbraced to V frames.

V type of bracing is preferable as it tendsto reduce the timeperiod, treduce thelateral displacementin both Xtand Z direction by a good margin.

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