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Seismic Analysis of Steel Building with Bracing

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Abstract: As we know that construction of steel buildings is popular nowadays. To protect buildings from earthquake by providing bracings are very common. Bracing help to resist the lateral load during earthquake. Bracings are providing in structure at various configuration. This paper illustrates the effect of new bracing configuration with existing x bracing configuration. The seismic analysis of the structure has been carried out using ETABS Software.
Keywords: Steel Building, Bracing, Seismic Analysis

I. INTRODUCTION

Earth quakes are the natural phenomenon's which are caused by the release of large strain energy by the moving faults below the surface of the earth, which ultimately causes the shaking of the earth top surface in all possible directions with different amplitudes and intensities of lateral forces. In case of steel structure to resist the lateral force and increase the stiffness of steel frame, so bracings play very vital role. Bracing will make the structure indeterminate. Its stiffness the structure and also helps to resist the sway of the structure.

Common reason for providing bracing on steel building is to control the buckling, increase the stiffness and to resist lateral load. In steel building there is a chance of buckling by providing bracing the buckling and stiffness of the structure can be improved to a limit. So here bracing with different configuration are provided in regular and irregular building to know the performance of the building.

A. Bracing

Bracing systems helps to evenly distribute load and increase the safety of the structure. Bracing types-Single diagonal, Cross Bracing, K-bracing, V- bracing.

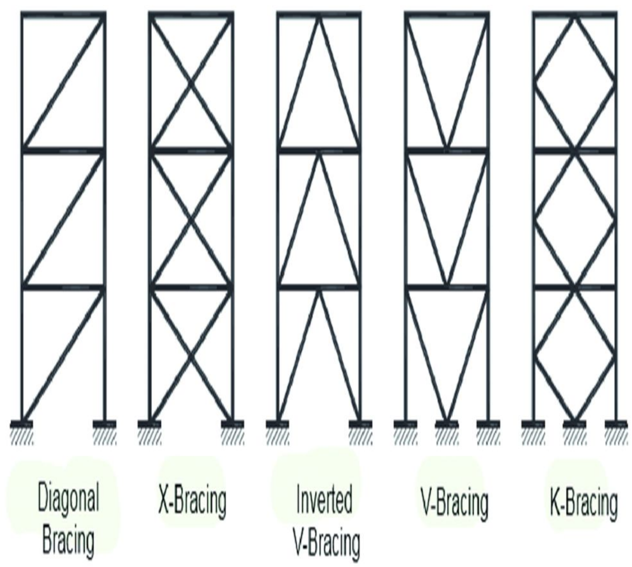

FIG 1: TYPES OF CONCENTRIC BRACING

B. Frame With Bracing Configuration

Here in my study, I took an already existing x bracing configuration to done a comparative study on new configuration ie crisscross Configuration to know the effectiveness.

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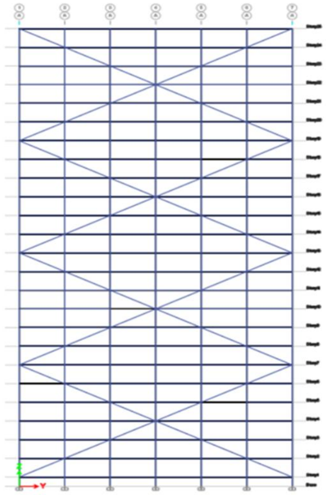
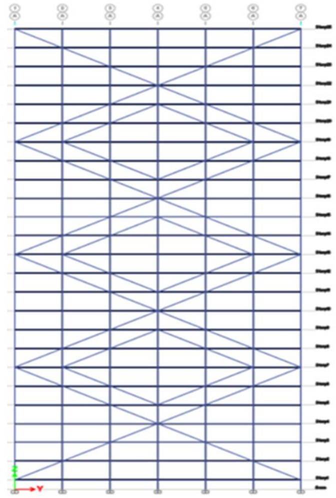
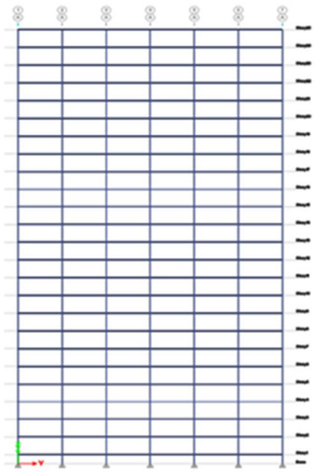

Fig. 2: X bracing configuration Fig. 3: Crisscross configuration Fig 3: frame without bracing and damper

C. Modelling

Steel building of 25 storey (G+25) with a same floor plan of 6-6m bays along longitudinal direction and 6-6m bays along transverse direction is modelled without bracing, with x bracing configuration and with crisscross bracing.

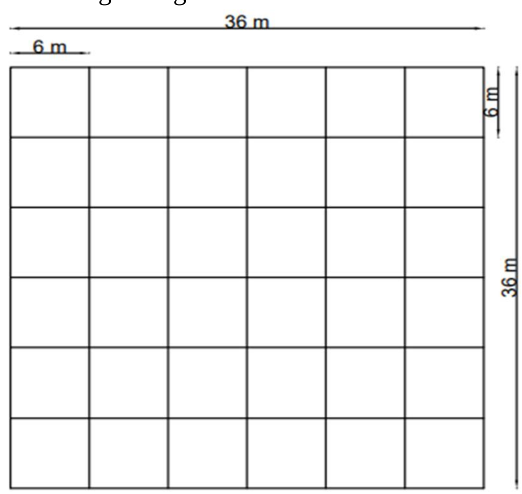

Fig. 4: Building Plan

II. RESPONSE SPECTRUM ANALYSIS

Response Spectrum Analysis was performed by using the ETABS software. ETABS offers a single user interface to perform modelling, analysis, design, and reporting. There is no limit to the number of model windows, model manipulation views and data views.

TABLE I
BUILDING DETAILS

No. of storey	G+25
Floor Height	3m
Steel Grade	Fe 345
Concrete Grade	M25
Beam	ISWB 300
Column	ISHB 400
Slab Thickness	150 mm
Bracing	ISWB 550

TABLE II
VALUES TAKEN FOR ANALYSIS

Seismic zone	3
Zone factor	0.16
Response Reduction factor	5
Type of soil	2
Importance factor	1

A. Modelling in ETABS

Model of 25 storey (G+125) steel building for the analysis is created in ETABS software.

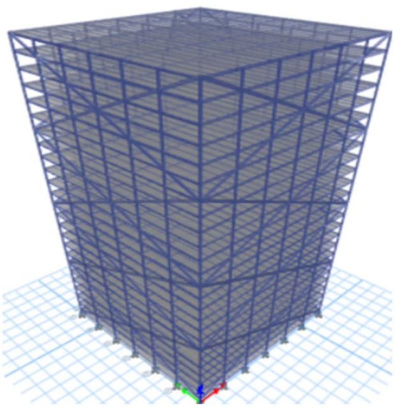

Fig. 5: Model with X bracing configuration

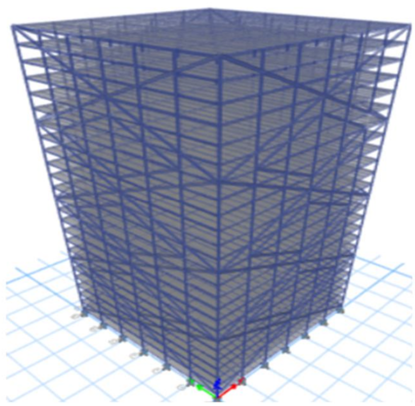

Fig. 6: Model with crisscross configuration

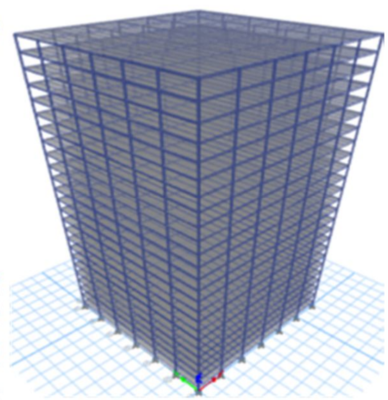

Fig 7: Model without bracing

III. RESULTS OF RESPONSE SPECTRUM ANALYSIS

Steel buildings was analysed using ETABS software. Seismic analysis was done and result of Storey Displacement and base shear is taken for the study

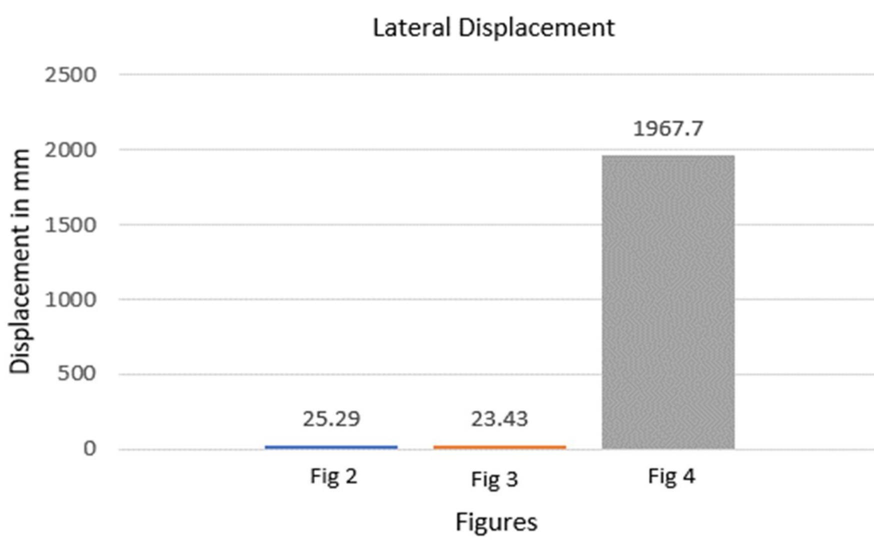

Fig 13: Lateral Displacement

The lateral displacement graph shown in Fig 13 shows that the lateral displacement of building with crisscross is less when compared with other buildings.

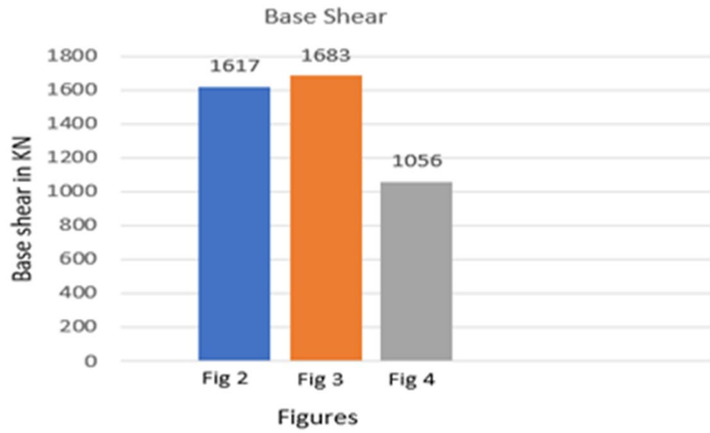

Fig 14: Base Shear

The base shear graph shown in Fig 14 shows that the base shear of building with crisscross is high when compared with other buildings.

IV. CONCLUSIONS

On the bases of present study following result has been constructed:

1) A proper lateral load resisting system is required to increase lateral strength and stiffness of high-rise buildings.
2) In present study two types of bracing ie. X-bracing and crisscross bracing are used as a lateral load resisting system which reduced lateral displacement from 196.7 mm in bare frame to 23.4 mm, but increased base shear from 1056 KN to 1683 KN which is not a desirable situation.
3) In overall comparison of bare frame and bracing system, frame provided with crisscross bracing configuration has good structural performance as compare to other systems.

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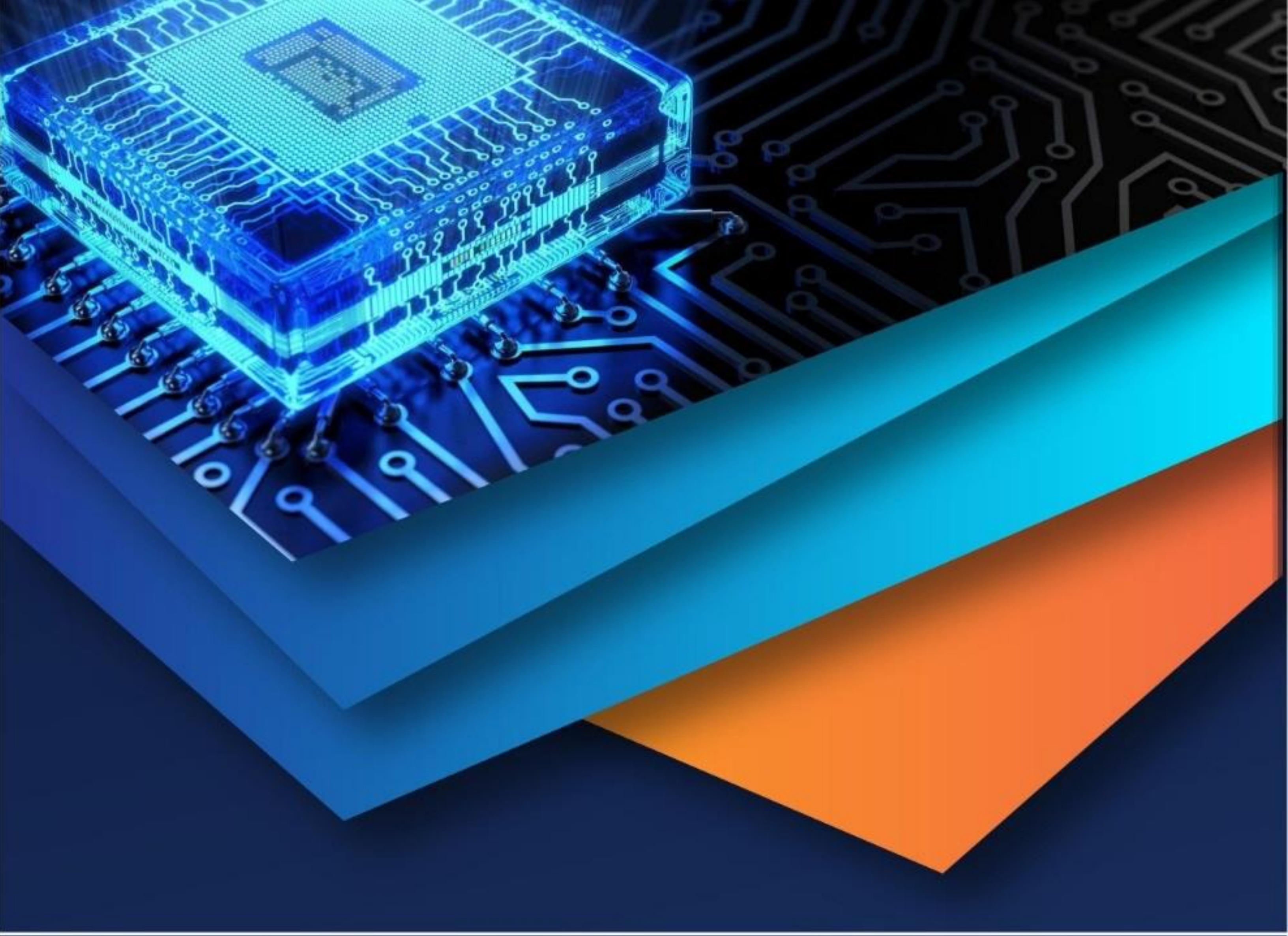

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