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Analysis of Diagrid structures and Bare Frame Structures using E- TABS and Comparing Symmetric and Asymmetric Plan

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Abstract – **In this paper, the analysis of the structure located on ground during an earthquake is studied. An ordinary moment resisting building of G+10 stories located over a medium soil is focused. In the symmetric building, In the symmetric building, five bays are kept along both direction while in the Asymmetric building, 5 bays are along Y direction and 4 bays along X direction. Zone V is analyzed by considering the response using E TABS 2016 software and the parameters analyzed are story drift, story shear, base shear and modal time period.**

Keywords—Story drift, story shear, base shear, modal time period

I. INTRODUCTION

The rapid growth of urban population and consequent pressure on limited space have influenced the residential development of the city. Tall business structures are fundamentally a reaction to the exceptional inaccessibility of land. In recent years, diagrid structures have received increasing attention among both designers and researchers of tall buildings for creating one-of-a kind signature structures. Diagrid is a particular form of space truss. The term 'diagrid' is a combination of the words 'diagonal' and 'grid' and achieves its structural integrity by using triangulation. It consists of perimeter grid made up of a series of triangulated truss system. These structures consist of modules which are in diamond shape the property of lateral stiffness is provided more in Diagrid structures rather than the conventional type of structures. Since they carry lateral shear by means of axial action of diagonal members, diagrid structures are more effective in minimizing shear deformation. Diagrid had good appearance and is easily recognized. The configuration and efficiency of diagrid structures helps in avoiding interior and corner columns, therefore avoiding significant flexibility with the floor plan.

The Hearst Tower in New York City is one of the iconic and awarded 'green' diagrid buildings in the world .In this paper, structure located on a normal surface is analyzed. The building is considered under Zone V by response spectra method considering parameters like lateral story displacement, story drift, story shear and modal time period.

II. PROPERTIES

A. Merits of Diagrid System
- Diagrid structures are aesthetically dominant and expressive.
- They make maximum exploitation of the structural material.
- They have mostly column free exterior and interior, hence free and clear, unique plans for floor are possible.
- Construction techniques are simple.
- Use of diagrids results in roughly $1/5^{th}$ reduction in steel as compared to braced frame structures.

B. Demerits of Diagrid structures
- It is heavy handed if not executed properly
- There exists limitation of height of 100 storeys for diagrid constructed of steel and 60 storeys for diagrid made of concrete.
- Lack of availability of skilled workers.
- The construction techniques of diagrid are not explored.
- It's hard to design windows that create a regular language from floor to floor.
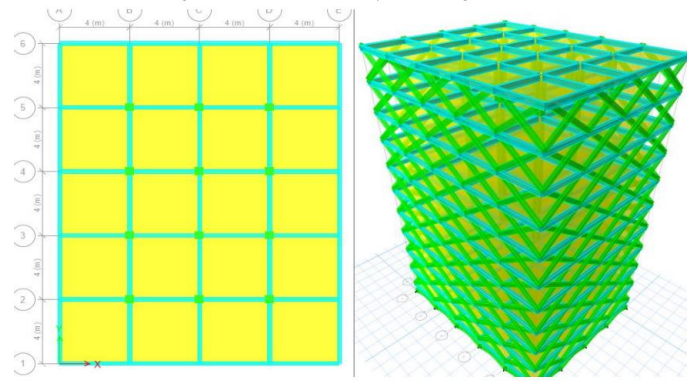
III. OBJECTIVES
- To analyze the diagrid structure with plan irregularity for seismic loading.
- To analyze and compare parameters like base shear, top storey shear, time period, , story drift , top storey displacement.
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- Storey shear of all models are compared.
- To study the response of buildings under dynamic loading (Earthquake load)
- To examine response of high rise building with diagrid system
- Finally, complete content and organizational editing before formatting. Please take note of the following items when proofreading spelling and grammar:

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A. METHODOLOGY

Here, the three dimensional frame analysis is done for 4 different building configurations resting on fee surface and is under the action of seismic (earthquake load).These configurations include : symmetric bare frame, asymmetric bare frame, symmetric structure with diagrid and symmetric structure with diagrid in seismic zones V.

Models considered include:

Model 1: Symmetric bare frame structure in Zone V
Model 2: Symmetric Diagrid bare frame structure in Zone V
Model 3: Asymmetric bare frame structure in Zone V
Model 4: Asymmetric diagrid structure in Zone V

Plan and 3D view of symmetric Bare Frame

Plan and 3D view of Asymmetric Bare frame

Plan and 3D view of symmetric Diagrid structure

Plan and 3D view of Asymmetric Diagrid structure

B. RESULTS AND DISCUSSION

The performances of all the models are observed and the results are extracted. The various models are considered and these results are compared

Lateral Displacement for symmetric frame along X – Direction

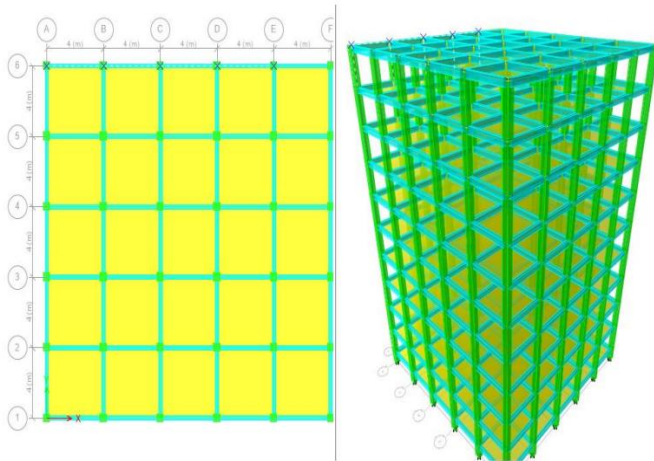| Storey Level	Symmetric Bare Frame	Symmetric Diagrid frame
5	31.451	10.912
4	16.234	8.124
3	10.544	5.412
2	5.213	2.587
1	0.713	0.789
0	0	0

CONCLUSION

Framing Building without any load resisting system shows highest drift when compared to diagrid system.

They give sufficient efficiency to lateral loads considering the fact that all peripheral vertical coloumns have been eliminated.
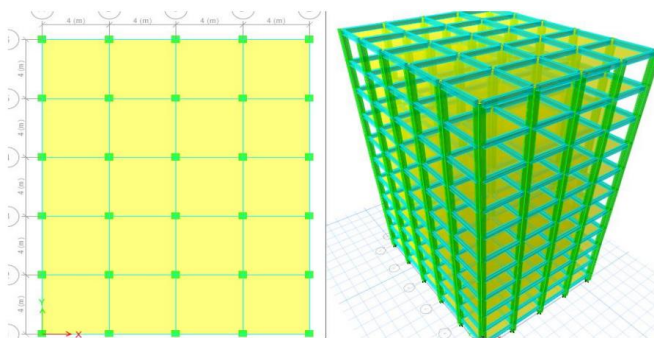
They give more aesthetic look and gives more interior space due to less coloumns and façade of the building can also be planned more efficiently.
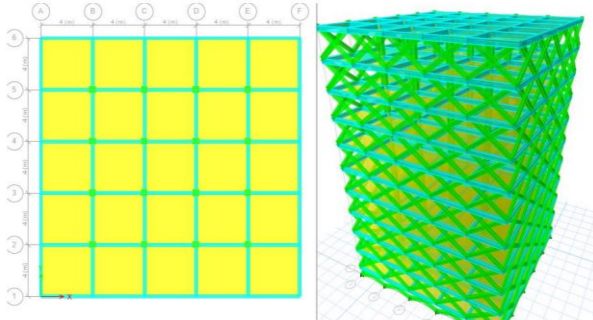
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