DYNAMIC ANALYSIS OF DIAGRID STRUCTURE IN HIGH RISE RCC BUILDINGS WITH VARYING GEOMETRY

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Abstract-*In high rise building, the structural design involves many factors like economics, aesthetics look etc. A diagrid structure provides great structural effectiveness without vertical columns in periphery of the structure. A diagrid structure is a type of structural system in which the diagonal grids connected through vertical rings which produce a pleasing and grateful in appearance. In the present study a G+15 multistoried R.C.C structure model is modeled using Etabs software. Building models are analyzed by Etabs software to study the effect base shear, drift, displacement etc.*

Keywords- Diagrid, Diagrid structure, Storey Displacement, Storey drift, Base share etc.

1. INTRODUCTION

The diagrid structural system is defined as a framework formed by the intersection of different elements like concrete, metals or wooden that are uesed in the construction work. The diagrid structural system is popular in the design of tall buildings. Diagrid is an exterior structural system that eliminates all pheripheral vertical columns and leaving only inclined columns. When compared to the bending of vertical columns in a framed tube structure, the axial action of these diagonals resists shear and overturning moments.

2. AIM AND OBJECTIVE

To Analyze the diagrid Structural System in High Rise RCC Buildings with Varying Geometry subjected to dynamic loads.

Objectives

- Identify effect of lateral forces on high rise buildings with varying geometry.
- Analyze the performance of diagrid structural system with suitable geometry in the respective zone.
- Analyze the suitable position of diagrid structural system according to the respective lateral load.
- Analyze the response of buildings in terms of maximum storey displacement and maximum storey drift, Base reaction Etc.

3. LITERATURE REVIEW

Md Zahid Hasan Sabuz, Muhammad Faizal, Md Khairuzzaman, Tanjim Hasin[1] author was studied the performance of different optimal angles in diagrid structural system. In this paper, author concluded the most cost-effective section; the optimal angle range of diagrid is 65 degrees to 75 degrees.

Pruthak Patel [2] researchers was focused on the correlation between diagrid structure and RC framed structure based on the result obtained from ETAB software. Researchers have studied on the response of buildings in terms of storey shear, storey drifts, storey stiffness and storey overturning moment.

In this paper it was found that the base shear for the diagrid structures is 4 times lesser than the orthogonal structures.

Sameeran R. Takle[3] researchers have studied the response of buildings in terms of storey shear, base shear, time period, base moments, maximum storey displacement and maximum storey drift. The analysis of conventional structure and diagrid structure on the basis of quantity of steel & weight and displacement are also mentioned. From the study, it was observed that most of the lateral load was resisted by diagrid columns on the periphery, while the gravity load was resisted by both the internal columns and peripheral diagonal columns.

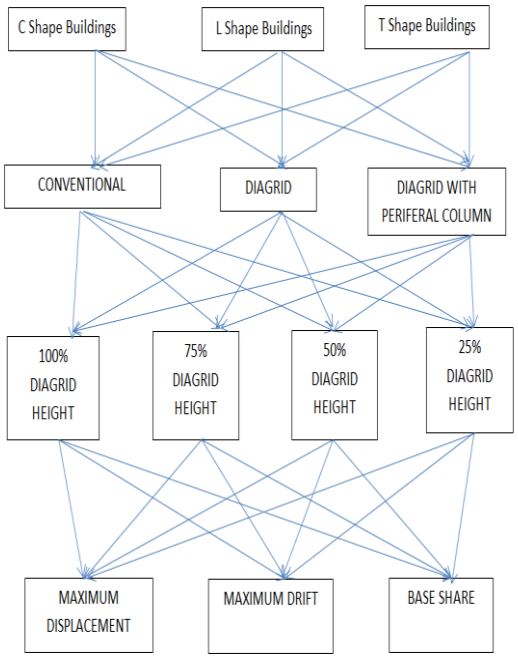
4. PROBLEM FORMULATION

Table 4.1: Specification of Modeling

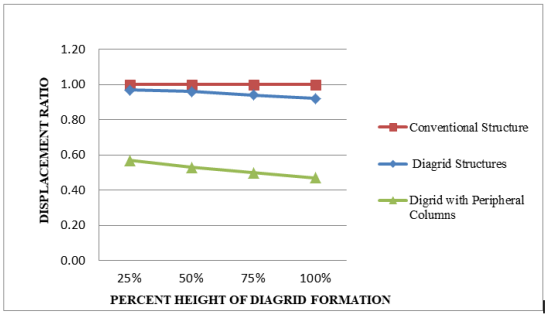
Live Load	4kN/m^2
Density of RCC Considered	25kN/m^3
Steel	HYSD 500
Thickness of slab	225mm
Depth of beam	600mm
Width of beam	500mm
Dimension of column	750x750
Height of each floor	3m
Earthquake Zone	III
Damping Ratio	5%
Importance Factor	1.5
Type of Soil	Medium soil
Type of structure	Special moment resisting frame
Response reduction factor	5
Type of diaphragms	Rigid
Load combination	All load combination as per IS 1893-2016
Type of support at base	Fixed

5. CASE CONSIDERED

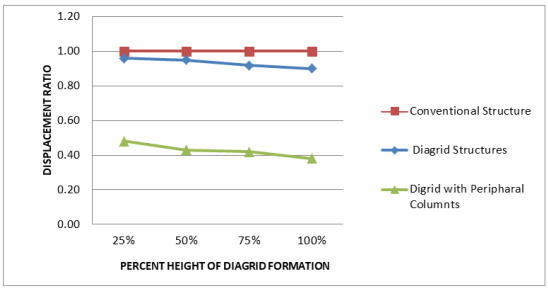
As mention the shape of building diagrid structure and percentage height of diagrid structure for existence of peripheral columns are considered for advises. The cases considered are as shown in flow chart.



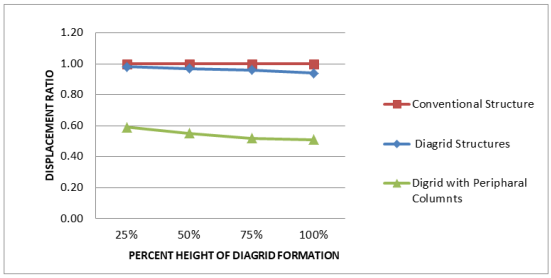
5.1Variation of Displacement:



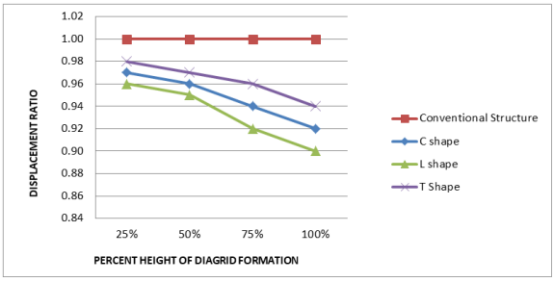
G1.Variation of displacement ratio against percent variation of height of structure for C shape building



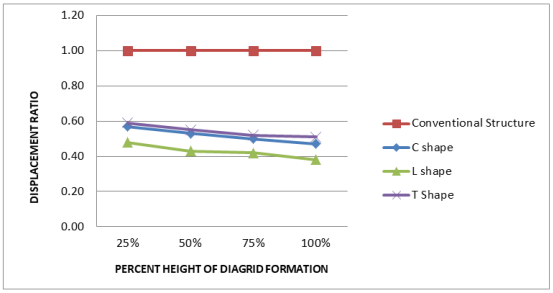
G2.Variation of displacement ratio against percent variation of height of structure for L shape building



G3.Variation of displacement ratio against percent variation of height of structure for T shape building

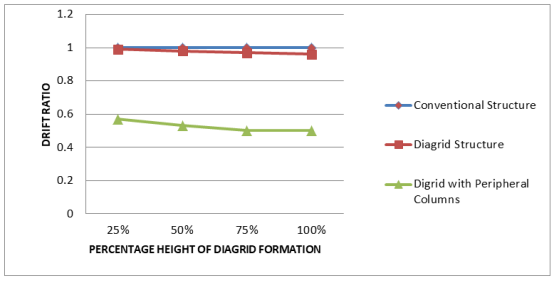


G4.Variation of displacement ratio against percent variation of height of structure for C, L, T shape diagrid building

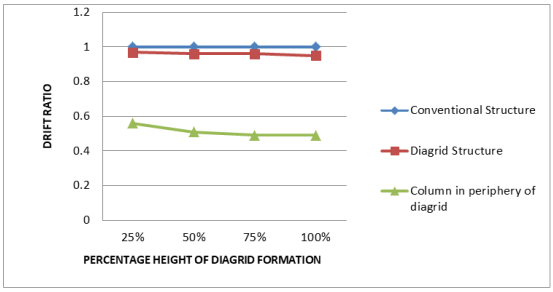


G5.Variation of displacement ratio against percent variation of height of structure for C, L, T shape Column in periphery of diagrid building

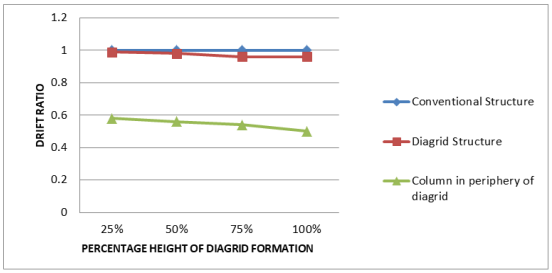
5.2 Variation of Drift:



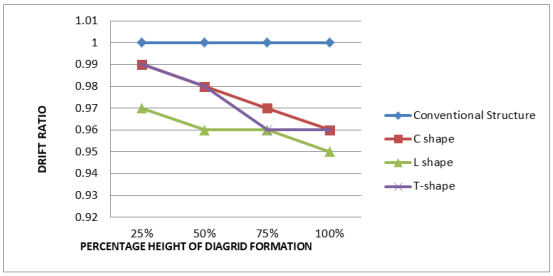
G6.Variation of drift ratio against percent variation of height of structure for C shape building



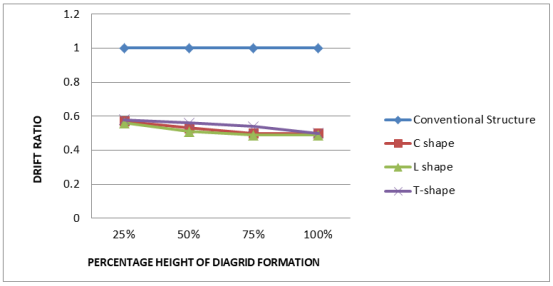
G7.Variation of drift ratio against percent variation of height of structure for L shape building



G8.Variation of drift ratio against percent variation of height of structure for T shape building

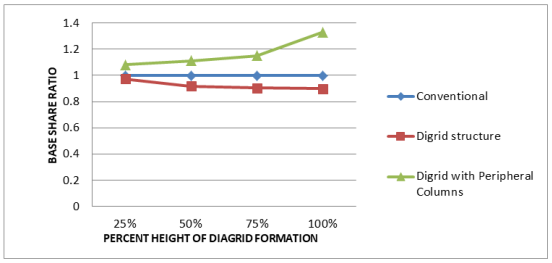


G9.Variation of drift ratio against percent variation of height of structure for for C,L,T shape of diagrid building

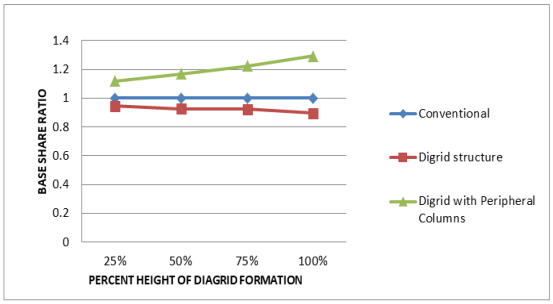


G10.Variation of drift ratio against percent variation of height of structure for C,L,T shape Column in periphery of diagrid building

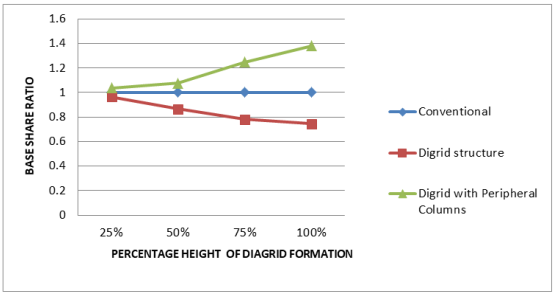
5.3 Variation of base share:



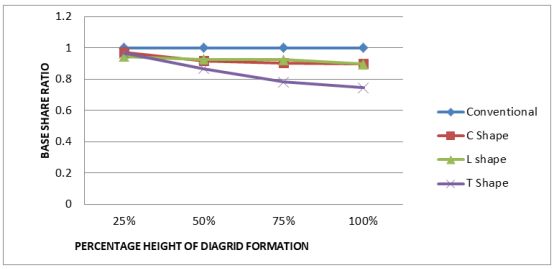
G11.Variation of base share ratio against percent variation of height of structure for C shape building



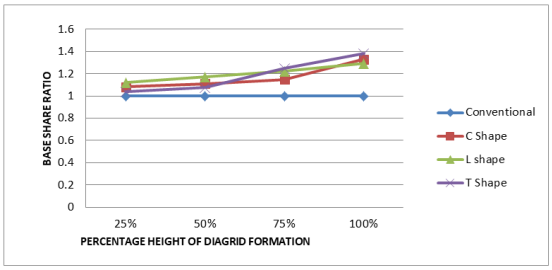
G12.Variation of base share ratio against percent variation of height of structure for L shape building



G13.Variation of base share ratio against percent variation of height of structure for T shape building



G14.Variation of base share ratio against percent variation of height of structure for C, L, T shape of diagrid building



G15.Variation of base share ratio against percent variation of height of structure for C, L, T shape Column in periphery of diagrid building

6. CONCLUSION

1) Diagrid structure increases attractiveness of structure as well as gives maximum interior space due to diagrid formation.

2) Drift of each story and story Displacement and are observed to be lower in diagrid structure as compared to conventional structure.

3) Displacements of the structure reduce as diagrid formation height increases.

4) Floor loads are more in conventional structure as compared to diagrid structure.

5) Reduction in displacement is similarly observed for all shape of plans like C, L& T shapes.

6) Drift of the structure reduces as diagrid formation height increases.

7) Reduction in drift is similarly observed for all shape of plans like C, L& T shapes.

8) Base share of the structure reduce as diagrid formation height increases.

9) Diagrid with peripheral column gives higher base share as compared to conventional structure.

REFERENCES

1. Md Zahid Hasan Sabuz, Muhammad Faizal, Md Khairuzzaman, Tanjim Hasin. "Review on performance of Diagrid structural system in Tall Building"International center for Research and Resource Development (2021):2773-5958

2. Pruthak Patel. "Comparative Analysis of Diagrid Structure and Orthogonal Structure with Different Design Parameters" International journal of Innovative Research in Technology(2021):ISSN: 2349-6002, Volume 7 Issue 11

3. Sameeran R. Takle. “Dynamic Analysis of Diagrid Structural System in High Rise RCC building with Varying Geometry” International Journal of Engineering Research & Technology(2020):ISSN:2278-0181, Vol.-9 Issue 12

4. Singh, Gurpreet. "Dynamic analysis of diagrid structural system in high rise steel buildings” Technology 9.8 (2018): 71-79.

5. Akshat, Gurpreet Singh. "A review on structural performance of diagrid structural system for high rise buildings." Int. J. Innov. Res. Sci. Eng. Technol 7.2 (2018): 1315-1322.

6. Dipesh Joshi, Arpan Khatadia, Sujit Tare, Sandesh Mane, Dixita Sawant, Nilesh Gaikwad. “Diagrid Structure” International Journal of Recent Advances in Engineering & Technology(2017) 2347 - 2812, Vol.-5, Issue -2