Study the Behaviour of the RCC Structure With different Grid pattern against Earthquake

SAYED AADIL SAYED MISBAHUL ABEDIN *, Prof. P.B. AUTADE
[1]P.G. Student, PadmashriDr.VitthalraoVikhe Patil College Of Engineering Ahmednagar, India
[2]Associate Professor, Department of Civil Engineering, PadmashriDr.VitthalraoVikhe Patil College Of Engineering Ahmednagar, India

ABSTRACT

The present work concerned with the study on the behaviour of high-rise RCC structure that consists of different grid pattern i.e. hexagrid diagrid and shear wall. The present study analyses and compare results of multi-storeyed building for the G+40, To get the best Stability of structure by providing Diagrid, and shear wall. To analyses and compare the seismic parameters like base shear, lateral drift and displacement, etc.

Keywords: *earthquake analysis different grid pattern, ETABS 2016, RCC, shear wall, static and dynamic geometric and*

****Correspondence Author***
Email: sayed1310@gmail.com

INTRODUCTION

Static procedures are appropriate when higher mode effects are not significant. This is generally true for short, regular buildings.The seismic input is modelled using either modal spectral analysis or time history analysis but in both cases, the corresponding internal forces and displacements are determined using linear elastic analysis. The advantage of these linear dynamic procedures with respect to linear static procedures is that higher modes can be considered. However, they are based on linear elastic response and hence the applicability decreases with increasing nonlinear behaviour, which is approximated by global force reduction factors.Braced tubular structure is a tubular structure with diagonal bracings spanning multiple stories can be made up of steel & concrete and can efficiently resists shear by axial forces in the diagonalPenta grid , hexagrid , orthogrid etc. members with wider column spacing are observed to have reduced shear lag but with the obstructions to architectural view. Shear wall is a structural member in a reinforced concrete framed structure to resist lateral forces such as wind forces. Shear walls are generally used in high-rise buildings subject to lateral wind and seismic forces.

PROBLEM STATEMENT:

In this study, a comparative seismic analysis is done for multi-storeyed building of 40storeys, for Diagrid, Hexagrid and shear wall. The result of this analysis will include base shear, lateral drift and displacement, the conclusion will be findings of most suitable case of Diagrid, Hexagrid and shear wall depending on their analytical results.

METHODOLOGY OF PROJECT:

The methodology of this research will be as followed:

1. In present research we have used different model of Multi-Storeyed Building including Diagrid, and shear wall
2. Model the structure in E-TABS
3. Seismic analysis is done as per IS1893-2016
4. Running the model in E-TABS
5. Obtaining seismic parameters like base shear, lateral drift and displacement
6. Observation and comparison of result
7. Conclusion

PRELIMINARY DATA

Model

- Length in X direction=42m

- Length in Y direction= 30m
- Typical storey height=3m
- No. of storey =40,
- Diagrid height = 4 storey

Load Calculation

DEAD LOAD

- Self-weight of the member
- Super imposed dead load- 2kn/m2

LIVE LOAD- 2kN/m2

SEISMIC LOADING

- Z=0.36 (for zone V IS1893:2016)
- I=1.0 (importance factor)
- Soil Type II

R=5(Response Reduction Factor)

Codes used for analysis of the structure:-

- R.C.C. design : IS 456: 2000
- Earthquake design: IS1893: 2016
- Code for Dead load: IS875: Part1
- Code for Live load: IS875: Part 2
- Code for wind load: IS875: Part 2

The basic parameters considered for the analysis and design:-

- Slab depth: 125 mm thick :Assu
- Live load in floor area: 3 kN/sq m
- Live load in Balcony area:2 kN/s
- Live load in passage area : 2 kN/s
- Live load in urinals : 2 kN/sq m
- Floor finish load : 1.5 kN/ sq m
- Wall thickness : 600 mm thick wall
- stair case loading : 3 kN/sq m

A. 2D AND 3D MODEL G+40 Structure-

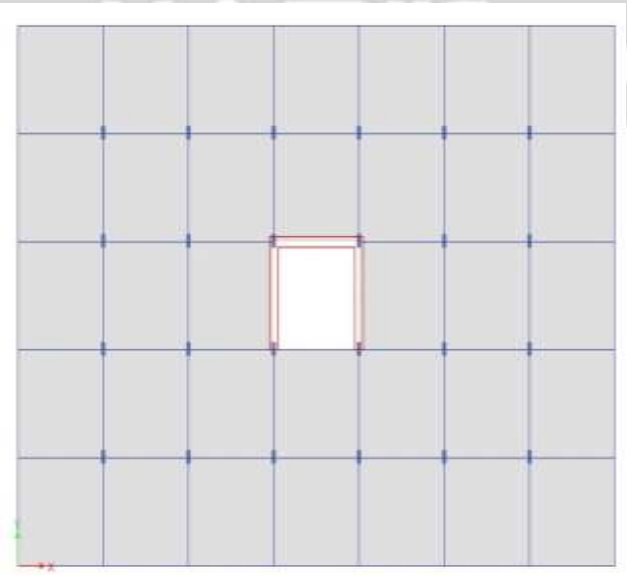


Fig 01- Show the building plan for diagrid building

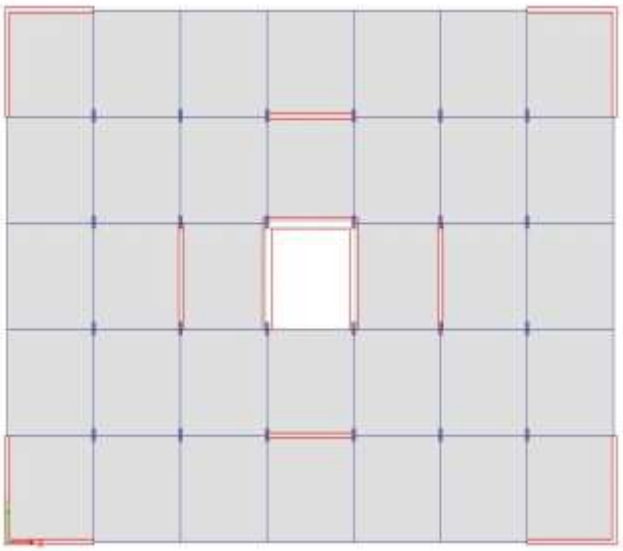
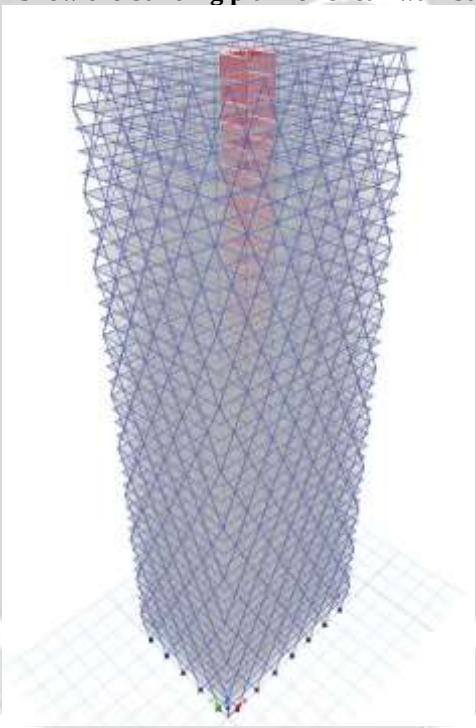
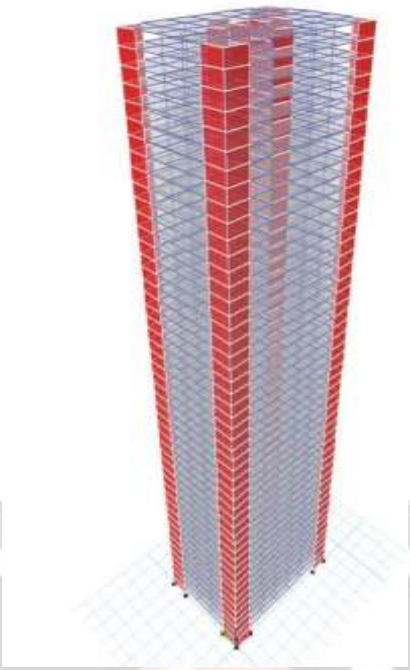


Fig 02- Show the building plan for shear wall building



a) Diagrid frame



b) Shear wall frame

Fig.03 shows the Various grid pattern of the structure with diagrid and shear wall

RESULTS AND DISCUSSION:

Modal Time Period-

Table 01 - Modal Time Period For Mode-1, 2 and 3 for all type of structure

Mode	Diagrid	Shear wall
Mode-1	4.911	4.241
Mode-2	3.922	4.053
Mode-3	1.878	3.208

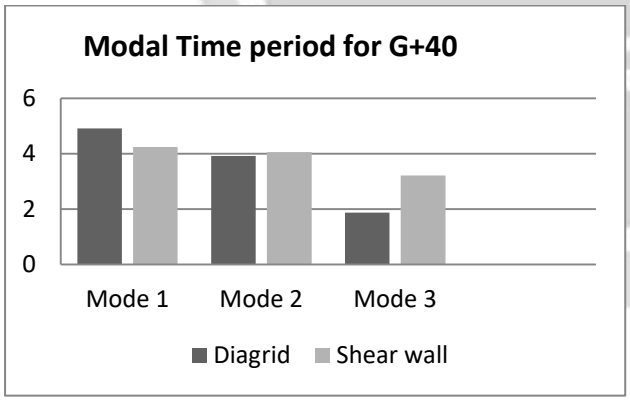


Fig. 04 Fig. 06 Modal time period for G+40 with all structure

Base Shear Details:-

Table 02 – Base Shear Details for Static and Dynamic load Condition in X and Y Direction-

Base Shear	Diagrid	Shear wall
Static Ex	5282.37	4265.4
Static Ey	5178.96	4265.45
DynamicEx	30620.75	24065.4

DynamicEy	30034.66	24429.18

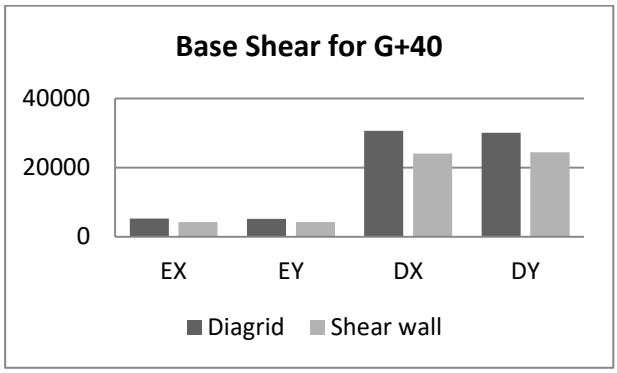


Fig. 05 Base shear for G+40

Displacement Details: –

Table 03 (A) – Displacement Details in X and Y Direction for Seismic Condition- :-

Displacement	Diagrid	Shear wall
Static Ex	0.113	0.138
Static Ey	0.181	0.121
Dynamic Ex	0.578	0.732
Dynamic Ey	0.934	0.619
Wind WX	0.104	0.161
Wind WY	0.227	0.197

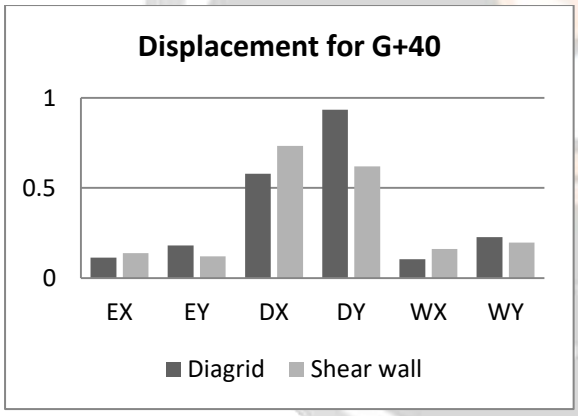


Fig. 6 Displacement detail for G+40

Drift Details: -

Table 04- Drift Details in X and Y Direction for Seismic Condition-

Drift	Diagrid	Shear wall
Static Ex	0.00105	0.00135
Static Ey	0.00175	0.0011
Dynamic Ex	0.00533	0.00598
Dynamic Ey	0.00904	0.00598

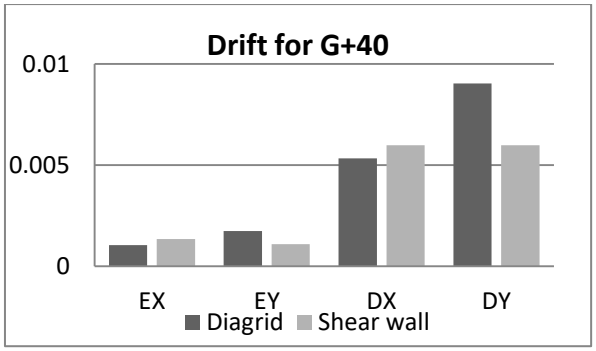
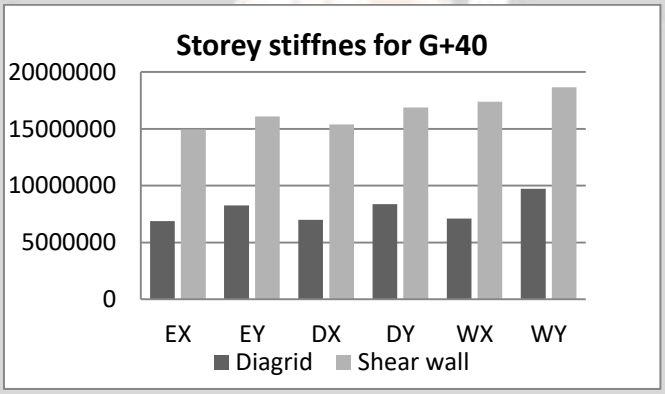


Fig. 7 Drift for G+40 with all structure

Max storey stiffness details for all structure for all structure

Drift	Diagrid	Shear wall
Static Ex	6877884	14941289
Static Ey	8254851	16088681
Dynamic Ex	6995198	15398449
Dynamic Ey	8366442	16865194
WX	7099440	17386451
WY	9733046	18663986



5. CONCLUSIONS: - Following are the conclusion we have obtained from above analysis results are: -

1. Time period
   When comparing diagrid structure with shear wall structure, diagrid show less modal time period then the shear wall structure in all considerable direction.

2. Base shear
   In case of comparing all structure, diagrid structure show more base shear as compared to shear wall structure in all considerable direction.

3. Drift
   Drift are getting more in case of Diagrid structure and less in shear wall structure in all considerable direction.

4. Displacement
   Displacement is increasing as the structure pattern is changing as shown in table. The shear wall structure is having higher Displacements value when compared with diagrid
5. Storey Stiffness
   Storey stiffness is increasing as the structure pattern is changing as shown in table. The shear wall structure is having higher storey stiffness value when compared with diagrid structure

6. REFERENCES

1. Taranath S. D., Mahantesh. N.B., M. B. Patil. "Comparative Study of Pentagrid and Hexagrid Structural System for Tall Building". Journal of Civil Engineering and Environmental Technology (ICEET), Volume 1, Number 2; August, 2014 pp. 10-15.
2. Biradar Sangita PremnathProf. M. V. Waghmare, "Seismic Analysis of Diagrid and Buckling Restrained Braced Structural System" International Journal for Modern Trends in Science and Technology (IJMTST), ISSN: 2455-3778 :Volume: 05, Issue No: 12, December 2019.
3. PeymanAskanNejad "Beehive (Hexagrid), New Innovated Structural System For Tall Building" CTBUH 2011 Seoul Conference.
4. SamanSadeghi, Fayaz R. Rofooei "Improving the seismic performance of diagrid structures using buckling restrained braces" Journal of Constructional Steel Research. 9 December 2019.
5. JayeshVenkolath, Rahul Krishnan K, "Optimal Diagrid Angle of High-Rise Buildings Subjected to Lateral Loads" International Research Journal of Engineering and Technology (IRJET), Volume: 03 Issue: 09, pp. 841-846, e-ISSN: 2395 -0056 p-ISSN: 2395-0072, September 2016.
6. Md. Samdani Azad, Syed HazniAbdGani, "Comparative Study of Seismic Analysis of Multi-story Buildings with Shear Walls and Bracing Systems" International Journal of Advanced Structures and Geotechnical Engineering (IJASGE), Volume: 05, Issue: 03, pp. 72-77, ISSN 2319-5347, July 2016.
7. Saeed Kia Darbandsari,, Maryam FirooziNezamAbadi , "A Comparative Study on Seismic Performance of Hexagrid, Diagrid and Tubular Structural Systems", Journal of Structural Engineering and Geotechnics, 7 (1), 55 -65, Winter 2017.
8. SafiyaDaliyaAhammed, Shahla C. P, "Seismic Behaviour of Hexagrid Type Structural System" International Journal of Engineering Research & Technology (IJERT), ISSN: 2278-0181, Vol. 8 Issue 02, February-2019