iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH
IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 10 Issue: X Month of publication: October 2022

DOI: https://doi.org/10.22214/ijraset.2022.47176

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
*ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538*
*Volume 10 Issue X Oct 2022- Available at www.ijraset.com*

# Structural Modelling of a (G+19) Building Considering Conventional and Diagrid Structure by Using ETABS and STAAD Pro

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***Abstract: The structural analysis programme ETABS V19 and STAAD PRO connect edition has employed. The results were compared to both the software used in present study. Results show that the natural time period is 14.68% more as per STAAD compared with ETAB it observed that it is 58.72% approximately decreasing for diagrid structure, the storey drift is 46.58% more as per STAAD PRO compared with ETAB, however it is 35.99% approximately increasing for diagrid structure. The displacement is 3.98% more as per STAAD PRO compared with ETAB however it is 32.09% approximately decreasing for diagrid structure. It is observed that the stiffness of the floor is 89.64% less as per STAAD PRO compared with ETAB for however it is 89.78% decreasing for diagrid structure. Results show that the base shear is 88.56% more as per STAAD PRO compared with ETAB, however it is 67.5% approximately increasing for diagrid structure for G+19 conventional building.***
***Keywords: Conventional and Diagrid systems, ISCODE-1893:2016, Natural Time Period.***

## I. INTRODUCTION

The city's private development has been significantly impacted by the metropolitan population's rapid growth and the tension that results from having limited space. Private structures have increased as a result of the high cost of land, the desire to avoid endless, never-ending suburbia, and the necessity to save important horticultural creations. The framework that resists lateral loads becomes more important as a structure grows in stature than the foundational framework that resists gravity loads. The rigid edge, shear divider, divider outline, propped tube framework, outrigger framework, and rounded framework are the commonly used horizontal burden opposing frameworks.

Due to its inherent productivity and fashionable potential provided by the revolutionary mathematical form of the framework, the diagrid, or Diagonal Grid, is currently the principal framework used for tall steel structures. Diagrid is easily seen and has a respectable appearance. The effectiveness and design of a diagrid framework reduce the number of underlying components required on a building's façade, providing less obstruction to the outside world.The diagrid framework's fundamental effectiveness also aids in avoiding inside and corner segments, allowing for a great deal of floor design flexibility. Comparing an edge "diagrid" framework to a standard second edge structure results in a weight reduction of about 20% of the primary steel. In diagrid main frameworks, the diagonal membrane can transmit horizontal powers and gravity stacks, because of the way they are situated. Diagrid structures are more effective at preventing shear twisting because they transmit sidelong shear through the

## II. LITERATURE REVIEW

In the study of Gurudath et al. (2019), which made use of ETABS 2015, a solidness-based plan technique was used to determine the primer part sizes of R.C.C. diagrid structures for a G+14 storey building. The approach was used to determine the best framework arrangement for the diagrid structure and to determine how well it correlated with the standard R.C.C structure. Using the Equivalent Static Method, a G+14 tale with a 630,660,690-edge diagrid was examined.According to the results, the tale uprooting and story float were largest for the uncovered edge of the RC and least for the diagrid-filled outline of the RC. Also, using a diagrid framework with a 63-degree slanting point, the Top story uprooting, story float, and tale toppling second were smaller. When compared to RC exposed edges, RC diagrid outline has relocation that is 78%–84% less; similarly, RC diagrid outline has float that is 78%–84% less when compared to RC uncovered casings. The RC exposed casing had the most Story toppling second, whereas the RC outline with diagrid had the least. The strength of the narrative was highest for the RC outline with diagrid and lowest for the RC exposed casing. Compared to RC exposed casings, RC diagrid outline has a stiffness that is 75%–82% higher.

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In this study, Akhand and Vyas (2019) planned a 16-story diagrid structure with an arrangement that is 18 m 18 m in size. Using the Staad competent programming framework, primary individuals are demonstrated and examined. According to IS 456:2000, all primary individuals were planned taking into account all heap blends. and Wind load as defined in IS 875-section 3 was taken into account for the construction's inspection and plan. The distribution of burden in 16 storey buildings was also read using the diagrid framework. The analysis and design of diagrids working in circular and triangular arrangements, as well as comparison with conventional construction, were concluded, according to the results. In addition, it was discovered that due to askew portions in the external border of the buildings, the diagrid structure is more viable in horizontal burden obstruction after inspection values were examined for Moment, Shear power, Axial power, Displacement, and Drift for seismic zone III. The inside segment was used of more modest size for gravity load opposition and a finest tiny amount of sidelong burden was regarded for it because of this resource of diagrid form. Due to the conventional design, every vertical and horizontal load was opposed by the exterior segment acting as a guide.

Shinde and Khan (2019) This essay examines a 20-story diagrid building in comparison to an externally propped outline structure. In terms of story shear, removal, float, and synopses of sidelong and gravity powers, examination results and plans for both models are presented. In the diagrid structures, the upward segments from the periphery are killed, which creates the fundamental contrast between diagrids and outside supported edges. The diagrids had the option to carry the gravity and parallel weights after locating the arrangement. As the diagonals transport the piles pivotally, they also effectively restrict shear misshapen. Due to its stability and adaptability in compositional arranging, the diagrid underlying skeleton is now used for tall constructions. Regardless of the relative abundance of vertical segments put in the diagrid structure's periphery, results showed that the diagrid structure resists nearly equivalent amounts of lateral loads when compared to the outside propped structure. The productivity of a diagrid structure is higher than a supported construction. In comparison to the supported casing construction, the diagrid structure showed reduced story shear. The diagrid structure's popular narrative float was 30.7% lower than it was for the outside outline structure. In comparison to the outer outline structure, the popular narrative removal of the diagrid structure is reduced by 46.7%. The diagrid construction is more secure than the propped outline structure thanks to this load of components. Diagrid structures have fewer segments, which gives them a more fashionable appearance. They also provide more interior space.

A G+41 story multistory R.C.C. building model was considered in Tekla. (2020).'s study, which was exhibited using the Etabs 2018 programming. Structures situated in zone III were taken into consideration when examining the reaction range. The Etabs 2018 programming examines building models to take into account the effects of story shear, base shear, time span, base minutes, the most extreme story relocation and greatest story float, among other factors. In this inquiry, the diagrid structures for elevated constructions with shifting calculations were to be examined and planned. to investigate how parallel powers behave when applied to tall constructions with different math. diagrid underpinning frameworks should be applied to constructions in order to find the best way to display them with realistic calculations in a separate seismic zone. to compare and contrast the designs that rely on firmness boundaries, relative dislodging, flexibility, and blockage. To put forth a practical, financially feasible, and ideal diagrid underlying framework that is suitable for the individual sidelong burden. should consider how structures will respond to changes in time, base, base minutes,

## III. CASE STUDY

### *A. Case I Conventional Structure*

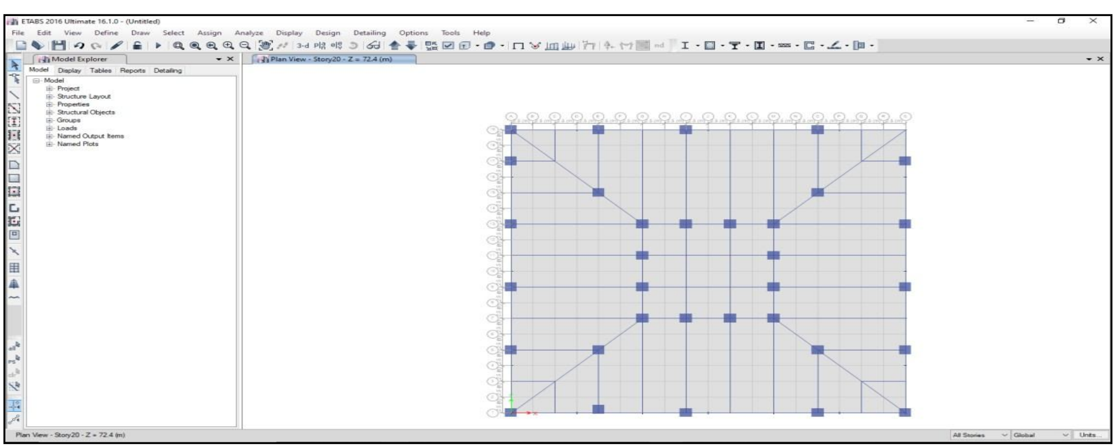

Fig 1 Conventional Structure

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### *B. Case II Diagrid Structure*

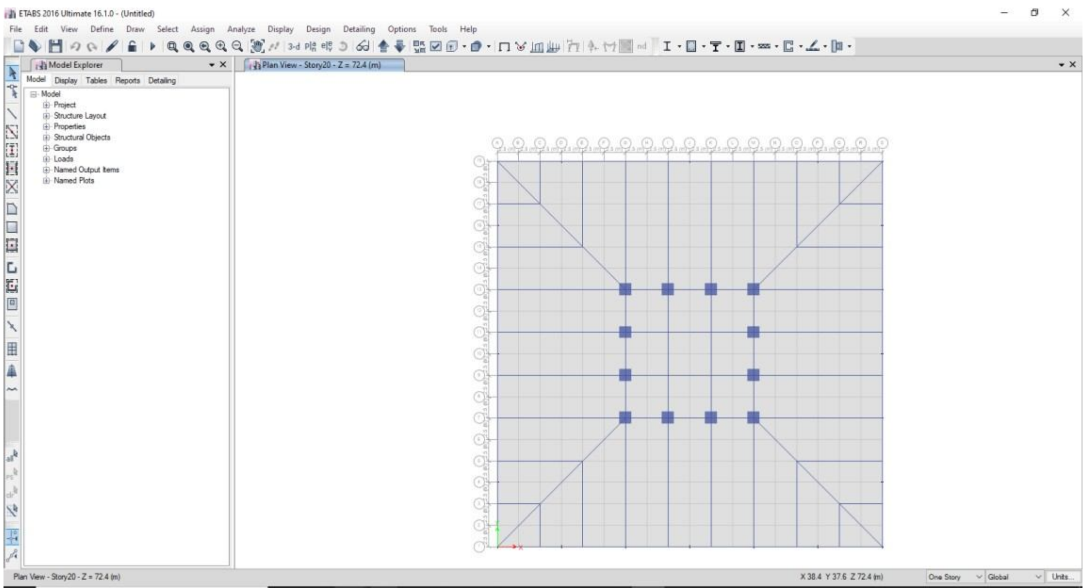


Fig 2 Diagrid Structure

### *C. Building Geometry*

Table 1 Geometry of the Structure

| Building Type | Commercial |
|---|---|
| Plan Area | 20mx20m |
| No. of Storey | G+19 |
| Height of Storey | 3m |
| Core Thickness | 400mm |
| Angle of diagrid | 67.4° |
| Size of columns: | 500mmX500mm |
| Size of beams | 300mmX500mm |
| Thickness of slab | 150mm |
| Size of Diagonals: | 300X500 |
| Size of steel square tube section used for Diagrid | 385.6mm X 385.6mm X 11mm |
| Support Type | Fixed |

Table 3.2 Material Properties

| | |
|---|---|
| Concrete grade | M25 |
| Grade of steel | Fe345 |
| Young’s Modulus (E)for M25 Concrete | $25x10^6$ kN/m$^2$ |
| Density of Concrete | 25 kN/m$^3$ |
| Density of Masonry Unit | 20 kN/m$^3$ |
| Poisson’s Ratio | 0.2 |

## IV. FLOW CHART OF ETABS

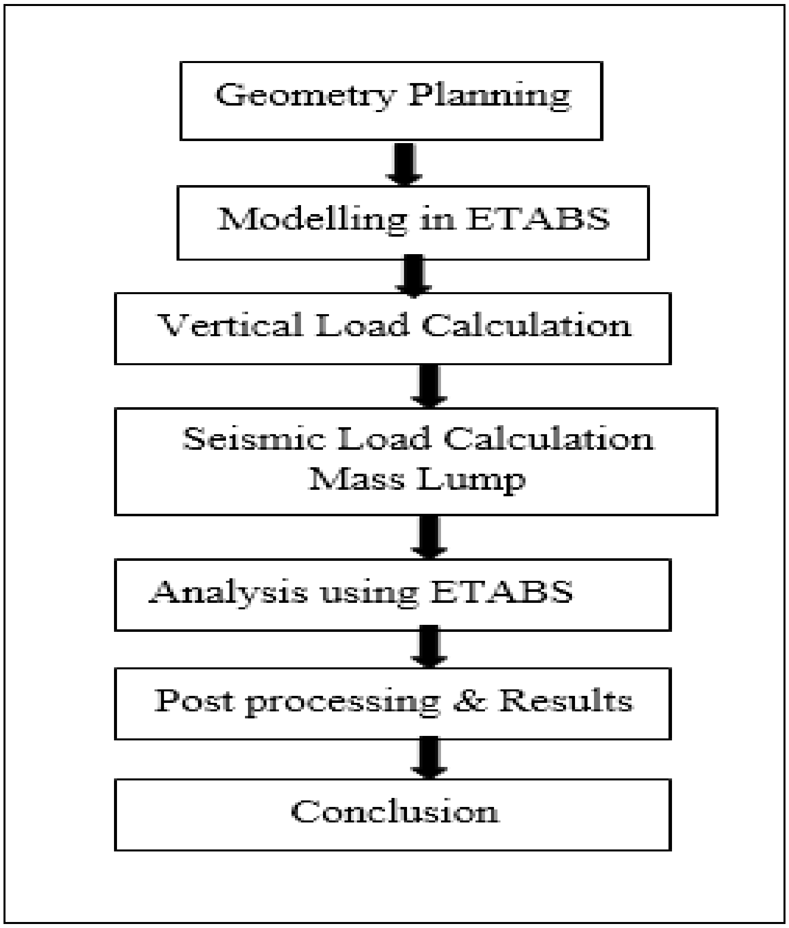


Fig. 3.: Flow Chart of ETABS

## V. CONCLUSIONS

Super plasticizers Results show that the natural time period is 14.68 % more as per STAAD compared with ETAB for G+19 conventional building, however it observed that it is 58.72% approximately decreasing for diagrid structure.

Moreover it is observed that the storey drift is 46.58% more as per STAAD compared with ETAB for G+19 conventionalbuilding, however it is 35.99% approximately increasing for diagrid structure.

## VI. ACKNOWLEDGMENT

This work was completed with the grants and facilities of Lakshmi Narain College Of Technology, Bhopal (M.P.). Authors are thankful to this institute and faculties for extending this cooperation.

## REFERENCES

[1] Abhra Tandon, Praveen Singhai(2021)Seismic Analysis of A Tall Structure Considering Diagrid And Tuned Dampers Using ETABS A ReviewInternational Journal of Scientific Research in Civil Engineering © 2021 | IJSRCE | Volume 5 | Issue 6 | ISSN : 2456-6667 pg no. 139-148.

[2] Andre R. Barbosa And GarlanRamadhan,[Seismic Performance Of A Tall Diagrid Steel Building With Tuned Mass Dampers], "Edugait Press" 2014.

[3] Avnish Kumar Rai&RashmiSakalle,[Comparative Analysis Of A High Rise Building Frame With And Without Diagrid Effects Under Seismic Zones Iii & V],International Journal Of Engineering Sciences & Research Technology,2017.

[4] Bhavani Shankar And Priyanka M V, [Comparative Study Of Concrete Diagrid Building And Conventional Frame Building Subjected To Seismic Force],International Research Journal Of Engineering And Technology (Irjet) June -2018.

[5] Durgadas Ashok Rude1 , Harshvardhan Rangari2(2022)Analysis and Design Multi-storey Steel Staggered-Truss System RC Slab Using ETABsInternational Journal for Modern Trends in Science and Technology, 8(06):06-16, 2022 Copyright © 2022 International Journal for Modern Trends in Science and Technology ISSN: 2455-3778 online DOI: https://doi.org/10.46501/IJMTST0806002 Available online at: http://www.ijmtst.com/vol8issue06.html

[6] GarlanRamadhan And André R. Barbosa,[Improving The Seismic Performance Of Diagrid Steel Structures Using Friction Mass Damper], National Conference In Earthquake Engineering, Earthquake Engineering Research Institute, Anchorage, Ak, 2014.
[7] Gurudath, Ganesh BahadurKhadka And Hafiz Faiz Karim,[Analysis Of Multi- Storey Building With And Without Diagrid System Using Etabs], “International Journal of scientific research”, May 2019.
[8] IS:1893 (Part 1)-2016, “Criteria for Earthquake Resistant Design of Structures Part General Provisions and Buildings (Sixth Revision)”, Bureau of Indian Standard, New Delhi
[9] IS:875 (Part 1)-1987 , “Code of Practice for Design Loads (Other than Earthquake) for Buildings and Structures Part 1 Dead Loads (Second revision)”, Bureau of indian Standard, New Delhi
[10] IS:875 (Part 2)-1987 , “Code of Practice for Design Loads (Other than Earthquake) for Buildings and Structures Part 2 Imposed Loads (Second revision)”, Bureau of Indian Standard, New Delhi.
[11] IS-456-2000 code of practice for plain and reinforced concrete.
[12] JayeshAkhand And J.N Vyas,[Comparative Study Of Different Shapes Of Diagrid Structure System With Conventional System Using Response Spectrum Analysis],International Research Journal Of Engineering And Technology (Irjet),Apr 2019.
[13] Manthan I. Shah, Snehal V. Mevada, Vishal B. Patel,[Comparative Study Of Diagrid Structures With Conventional Frame Structures], Journal Of Engineering Research And Applications,May 2016
[14] MemanSuraiyabanu Mohamed Salim,[Comparative Study Of Diagrid System, Hexagrid System And Shear Wall System In Tall Tube-Type Building],Multidisciplinary International Research Journal Of Gujarat Technological University July 2020
[15] Mohammed Jawad Uddin(18u61d2009)*1, Ms Gollapalli Sandhya Rani*2"STRUCTURAL MODELLING FOR TALL FRAMED BUILDINGS", International Research Journal of Modernization in Engineering Technology and Science ( Peer-Reviewed, Open Access, Fully Refereed International Journal ) volume:04/Issue:03/March-2022 Impact Factor- 6.752 www.irjmets.com www.irjmets.com @International Research Journal of Modernization in Engineering, Technology and Science [2421] i.org/10.46501/IJMTST0806002 Available online at: http://www.ijmtst.com/vol8issue06.html e-ISSN: 2582-5208