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# A Study on Diagrid Structural System Used In Tall Buildings

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**ABSTRACT-** In the present days, High rise building construction is growing day by day due to lack ofland and increase in population especially in cities. When the height of a building increases,lateral load plays an important role on such buildings. To overcome such problems in high risebuildingsdifferenttypes of structural systems are used. Diagrid system is one such popularstructural system. It is a triangular beam system that can be curved or straight, and horizontalbeamsthatcreateahigh-risestructuralsystem.Sowehaveused the concept of this diagridstructure in our project.Themainaimofthisprojectistoinvestigatetheseismicbehaviourof RC diagridstructuralsystemsbyvaryingangletodetermineth eoptimumangleiscomparedwithconventionalbuildings asperIndian Standard code. Different analysis methods available toobtain the seismic response have been discussed and based on review of analysis methods asuitable method has been adopted for analysis of regular building models.

**INDEX TERMS**- Diagrid structural system, Diagrid in tall buildings

## I. INTRODUCTION

The rapid growth of urban population and the restriction of available land, the higher structuresare preferable now a day. So, consideration of lateral load is very crucial when theheight of thestructure rises. To this end, the lateral load resistant system becomes more essential than thestructural system resisting the gravitational loads. Rigid frame, shear wall, wall frame, bracedtube system, outrigger system and tubular system are the lateral load resistantsystemsthatarewidelyused.Duetoitsstructurale ffectivenessandaesthetic potentialsupplied by thesystem's distinctive geometric setup, the diagrid–diagonal grid structural system has recentlybeencommonly used for high-rise structures. Hence thediagrid,forstructuraleffectivenessandaestheticshasg eneratedrenewedinterestfrom architectural and structural designers oftallbuildings.

Diagridis a triangular beam system that can be curvedorstraight,andhorizontalbeamsthatcreateahigh-risestructuralsystem.Thedistinctionbetweenouter-bracedstandardconcreteframepatternanddiagridstructu ral patternisthatstandardvertical columns arenot used bythesestructures.Principle of Diagrid-the diagrid framework offers a few focal points not withstanding disposingof veneer sections. Most quiet it upgrades each basic component. Sections are usually used totransmit vertical burdens, and diagonals offer significant strengths, such as wind and seismicburdens,steadinessand impermeability.

## II. METHODOLOGY

The methodology states about different types of methods used for computing the resultparameters of building under seismic load. During earthquake, buildings need to beflexible enough to bear the vibrations caused by earthquake, if not then both non-structural as well asstructural components of building gets damaged.

Different analysis methods are available to obtain the seismic response have been discussedand based on review of analysis methods a suitable method has been adopted for analysis ofregularbuildingmodels.

## III. MODELLING OF BUILDING

Here, mathematical models are modelled which has story of G+15, Plandimension as 25mx25m, height of floor as 3m, Sizeofcolumns-750X750, Sizeofbeams- B1-300X600, B2-230X550, Slabthickness-200mm, Gradeofconcrete-M30, Gradeofsteel- Fe550, Seismiczone-V, Soiltype-Medium, Importancefactor-1.5, Reductionfactor-5, Liveload-2.5kN/m2, Floorfinish-1.5kN/m2, Methodofanalysis-Responsespectrummethod. These are the

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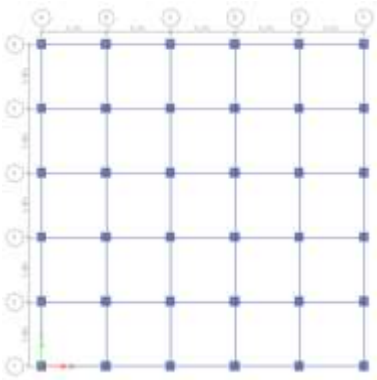
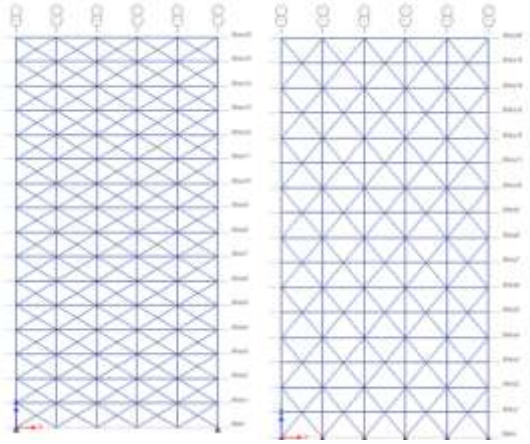


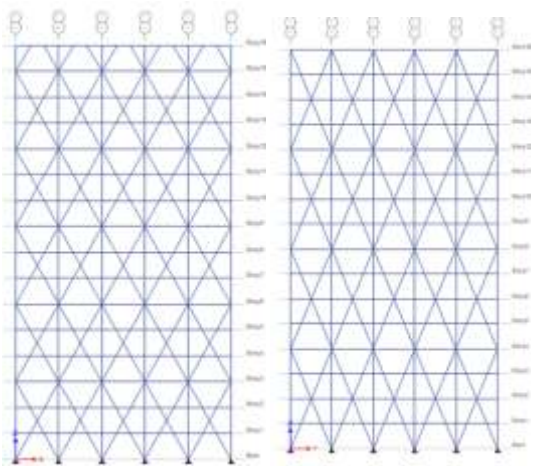
Fig 1 plan view for all models

Fig 2 elevation for conventional structurebuildingpropertiesconsideredforconventionalstructure.

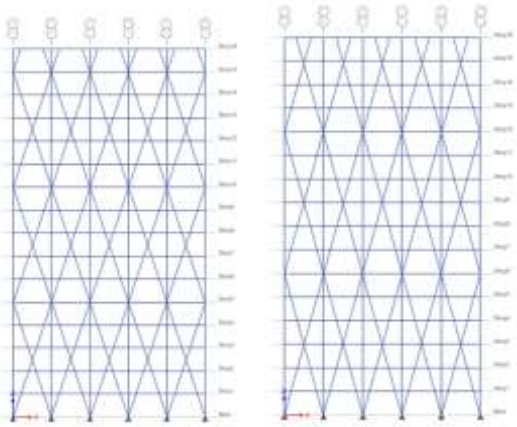
Fig 1 Shows plan view for all models and Fig 2 shows elevation for conventional structure.
The diagrid angle is based on the story module. Here, four different story module is considered, i.e., 1-story module, 2-story module, 3-story module, 4-story module, 5-story module, 6-story module as shown in Fig 3.



(a)Θ=30.5 1-storymodule (b)Θ=50.1 2-story module



(c)Θ=60.5 3-storymodule (d)Θ=67.2 4-story module



(e)Θ=71.3 5-storymodule (f)Θ=74.2 6-story module
Fig 3. Different Story Module

## IV. RESULT ANALYSIS

The Analysis of results for all the models are shown here in terms of time period, story displacement, story drift, story shear.

Time Period Results
Here the time period results are shown in Fig 4 and 5.

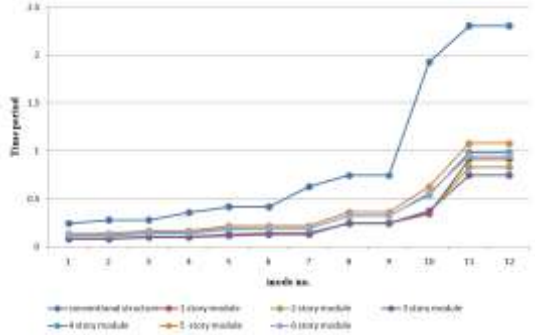


Fig 4. Time period of conventional structure and diagrid structure

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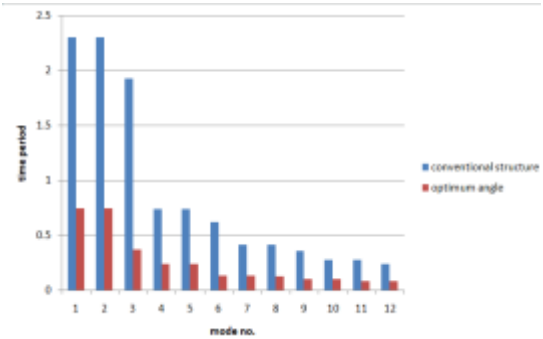


Fig 5. Comparison of Time period for optimum angle(60.5) and conventional structure

A. Story Displacement Results

Here the story displacement results are shown in Fig 6 and 7.

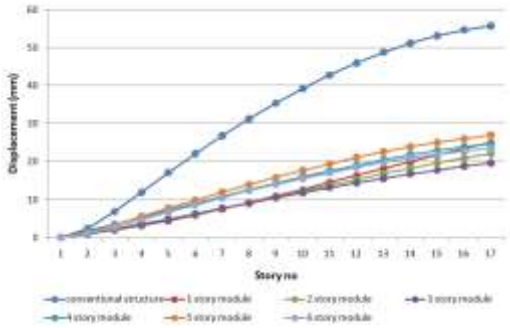


Fig 6. Story Displacement of conventional structure and diagrid structure

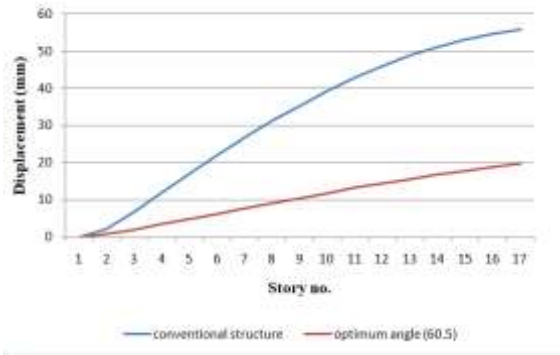


Fig 7. Comparison of Story Displacement for optimum angle(60.5) and conventional structure

B. Story Drift Results

Here the story drift results are shown in Fig 8 and 9.

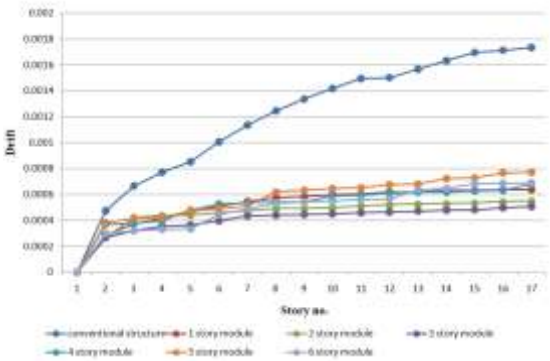


Fig 8. Story Drift of conventional structure and diagrid structure

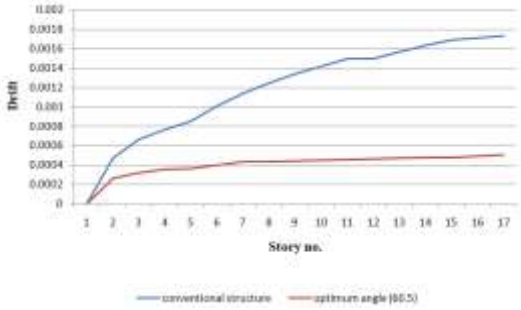


Fig 9. Comparison of Story Drift for optimum angle(60.5) and conventional structure

C. Story Shear Results

Here the story shear results are shown in Fig 10 and 11.

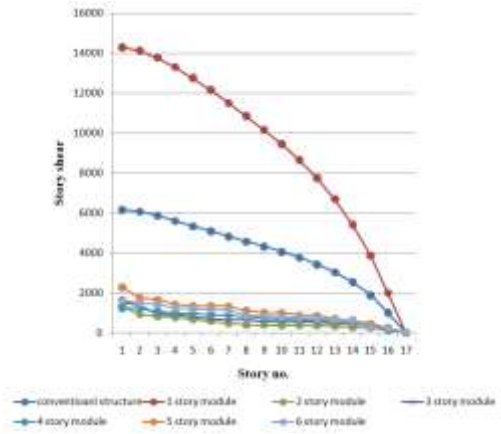


Fig 10. Story Shear of conventional structure and diagrid structure

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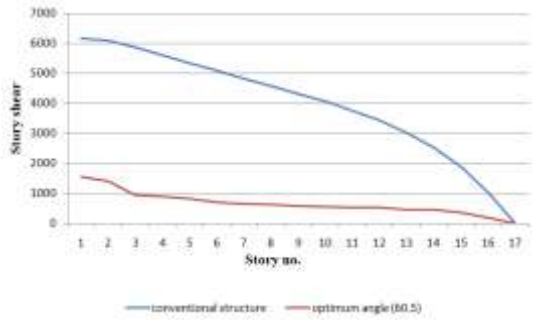


Fig 11. Comparison of Story Shear for optimum angle(60.5) and conventional structure

## V. CONCLUSION

The study has been done by considering the different angles of diagrid and different story of the building. The plan for 25m x 25m is considered with 6 different angles and we can conclude from that study as follows,

1. Seismic behavior of RC Diagrid system is investigated by varying angles to determine the optimum angle and seismic analysis is carried out by considering the effect of earth quake ground motions by using response spectrum method.
2. It is found that diagridstructure are more suitable for aerodynamic shaped buildings which improves aesthetic and structural performance with material saving potential.
3. Time period, Displacements, storey drift, storey shear on each storey are noticed to be less in diagrid systems whenmatchedwith conventionalframe.
4. Due to diagonal columns on its periphery, diagrid shows better resistance to lateral loads anddue to this, inner columns get relaxed and carry only gravity loads. While in conventionalbuildingbothinnerand exterior.
5. The Time period of 3 story module diagrid structure is decreased by 41% than the convectional structure.
6. The story displacement of 3 story module diagrid structure is decreased by 46% than the convectional structure.
7. The story drift of 3 story module diagrid structure is decreased by 34% than the convectional structure.
8. The story shear of 3 story module diagrid structure is decreased by 33% than the convectional structure.
9. Sofromresultsandcomparisonwithconventionalbuildingdiagridstructureforbetter lateralload resistance.

## VI. ACKNOWLEDGEMENTS

We are indeed grateful to many groups of people who have helped us with various aspects of this study. We would like to thank Prof Divyashree M as well as special thanks for our head of the department Dr B.S JayashankarBabufor giving us the opportunity to do this wonderful project on “A Study On Diagrid Structural System Used In Tall Buildings”.

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