

REVIEW PAPER ON DIAGRID SYSTEM IN TALL BUILDING

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Abstract –In recent days, construction of tall building increase day by day with different types of structural system. Diagrid system is popular system among different system in tall building because of its flexibility and aesthetic appearance. Diagrid is an exterior system in which diagonal struts and ties in the periphery are provided. In this paper the comparison of diagrid system with different type of structural system are discussed and the vertical and plan irregularities in diagrid system with variable diagrid angle and diagrid pattern are analyzed. This paper shows the comparison of different parameters like lateral displacement, storey drift, storey shear in different zones.

Key Words: High rise building, Diagrid system, Storey displacement, Storey drift, Time period, Variable angle.

1. INTRODUCTION

Now day's High rise building construction is growing day by day due to lack of land, high population on cities. When the height of building is increase lateral load also play important role on building. To overcome the problem in high rise building due to lateral load different type of structural system is used. Diagrid system is popular in tall building from past decade. Diagrid is combination of word diagonal and grid. It is the improvement on the conventional bracing system which system the entire vertical column on the perimeter is eliminated and diagonal column are used. Diagrid is formed combination of diagonal and horizontal component in which diagonal member act as inclined column and as bracing element and carry gravity load as well as lateral load. Diagrid structure can save approximately 20% of steel weight as compare to conventional moment frame structure. By using this system high rise building can be built in any geometric configuration as per architectural planning.

2 LITERATURE REVIEW

Anju Krishna (2015) has done the comparative analytical study of 36 storey building of six model. In model 75%, 50% and 25% is regular plan of total height respectively. Three model of diagrid with braced angle 74.5° and three of tubular structure. Linear static analysis is done with help of Etabs software and compares result in term of story displacement, inter storey drift. It is concluded that diagrid structure having vertical geometric irregularity shows less top displacement and inter storey displacement as compared to

tubular vertical geometric irregularity. Diagrid system also provides more flexibility to interior planning.

Khalid k. Shadhan (2015) analysed the high rise building applied wind load with varied diagrid angle to control lateral drift in high rise building subjected to wind load. Diagrid angle is varied to five different angle configurations has considered for different height 24, 48 and 72 storey steel building. Different cross section diagrid member with different thickness grade 50 steel pipes is used. Finite element analysis is done in ETABS and results are comparing in parameter lateral displacement and storey drift. It conclude that diagrid angle directly influence behaviour of high rise building under lateral load and optimum diagrid angle is small than 56° for 24 storey model and between 56° to 72° for 48 storey model & 72° for 72 storey model.

Ravish Khan & Sangeeta Shinde (2016) Studied two model diagrid structures with symmetric and asymmetric plan geometry. The location of building is in Aurangabad. Beam and daigrd are steel property column are concrete property. Linear static analysis is done on Staad.pro software. Result is analysis in term of storey drift, storey shear and storey displacement. It is concluded that top storey displacement of symmetrical model is 26% less than asymmetrical also top storey drift is less. Response of building is more efficient when subjected to wind load in symmetry of plan. Symmetric model comes out more efficient than the asymmetry in term of storey drift and storey displacement.

Snehal S. Mali et. al (2017) studied seismic response of diagrid building with conventional frame structure at seismic zone iv and soil type is hard. Model is of same parameter with diagrid and conventional frame. Position of diagrid in opposite face, three faces, and all faces in model are taken. Equivalent static analysis, Response spectrum analysis and wind analysis is done using ETABS software. Result is representing in term of displacement. It is conclude that at equivalent static analysis, response spectrum analysis of diagrid structure lateral displacement significantly less 45.48% and 41.71% , 45.92%, 42.17% in X, Y direction respectively as compared to conventional structure. At wind analysis lateral displacement significantly diagrid structure compared to conventional structure is less 45.34% in X and 41.59% in Y direction.

Chetan S. Pattar (2018) work the analysis 16 storey of diagrid structure with regular plan, C-type and L-type plan

irregularity at zone V. All the structure has same area 324 m². Response spectrum method used for dynamic analysis of structure and compared plan irregular structure with regular structure. Shear, top storey shear, top storey displacement, time period storey drift and quantity of material consumed by these term building are compared. It is concluding that consider base shear, top storey displacement, storey drift L-type diagrid structure is best and C-type structure consume least quantity of material.

Irfan Saleem (2018) studied circular diagrid structure with or without core shear wall with plan irregularities and asymmetric in nature. ETABS is used for modeling and dynamic analysis (Response spectrum analysis). Here the structure is at zone V and soil condition is type III. Storey shear, storey drift, storey displacement are parameters for conclusion. It is concluding that horizontal and vertical displacement at top reduces due to shear wall provided with diagrid structure. For aerodynamic shape diagrid structure is suitable. Torsion is generated in irregular structure therefore designer should try to avoid irregularities in multistory structure.

Trupti A. Kinjawadekar & Amit C. Kinjawadekar(2018) studied the seismic characteristics of diagrid system of 18 storey and 36 storey with different angle of diagrid 45⁰, 64⁰ and 72⁰. The dynamic analysis of structure is done on SAP 2000 software. Analysis is done for two dimensional plane frames. Total Eight model were analyzed four model for 18 storey including one bare frame other three are with different diagrid angle same for 36 storey model. Material used steel STY 310 yield stress 310N/mm² tensile stress 450N/mm². Storey drift, storey displacement, time period and base shear are characteristic were analyzed. It is concluding that for 18 storey frame diagrid angle 45⁰ to 64⁰ provide more stiffness and For 36 storey 64⁰ to 72⁰ provide more stiffness less top storey displacement. For diagrid angle 45⁰ to 64⁰ for 18 storey storey shear and storey drift is less and for 36 storey drift and storey shear less in region of 64⁰. Optimum angle of diagrid is around 64⁰ and economical region of diagrid angle is 45⁰ to 64⁰. Time period is minimum for diagrid angle 45⁰ to 64⁰ at first mode.

Swaral R. Naik et. al (2018) studied compare stability between the diagrid building model with conventional moment frame. Ten models are analyzed on the SAP2000 software. Different H/B ratio is taken are 1.7, 2.6, 3.5, 4.44 and 5.33. Ten models using six severe famous earthquakes with vast variation in their peak ground acceleration and duration analyzed by Non linear time history analysis. Comparison parameter is top storey displacement, time period of model. It is conclude that time period of simple model are all most 2.5 to 3.5 times higher than diagrid model because of diagrid model have higher stiffness. Also diagrid model shows less top displacement. Displacements model for lower H/B ratio much higher than low H/B ratio.

Akshat (2018) studied 60 storey steel building at seismic zone IV. He analyzed the building with various diagrid angles. Response spectrum analysis is done by using ETABS software. For economy number of diagonal element are used also ISWB 600 secondary bracing is used. Structure is analyzed both statically and dynamically for seismic load. Result is discussed in term of maximum storey displacement, maximum storey drift and maximum storey shear. It is concluded that by reducing the structural diagrid angle the lateral displacement and storey drift also reduced. 20% less steel is used as compared to conventional structure. Diagrid angle between 67.38⁰ to 71.56⁰ gives efficient result. By increasing the number of diagonal element on web and flange façade of structure top storey displacement and maximum storey drift get reduced.

Rajesh kumar (2019) studied the comparative high rise building between the diagrid structure system and braced frame system. Six model are made in three set each set having one diagrid structure type and one braced tube type.

Diagonal member is kept same but density has changed in set. G+48, G+32 and G+20 is number of storey in different three set situated in Chandigarh zone VI. Models are dynamic analyzed on ETABS and STAADPro software. Displacement, storey drift and base shear are used to compare the models. It is concluding that brace frame result much better for luxury building because it increase comfort condition in building. All building models with in permissible limit criteria. Braced frame increases cost of building.

3. SUMMARY AND CONCLUSION

The above literature review shows that comparison between diagrid structure models with conventional frame model, braced frame model. Also change diagrid angle, H/B ratio. Irregularities in structure also considered. response spectrum analysis, time history analysis studies are going on by using software ETABS, STAADPro and SAP2000. From above studied it is concluded that

- The diagrid structural model shows more stiffness than simple model due to this top displacement is less.
- Vertical irregularities in diagrid structure are less top storey displacement. There diagrid structure is more stable.
- Optimum Diagrid angle is change with respect to the height of model.
- Diagrid system is better solution for lateral load. Also for flexibility, economy for quantity of material consumes.

REFERENCES

- [1] Anju Krishna and Arathi S, "Analytical Study of Vertical Geometric Irregular Diagrid Structure and Comparison with Tubular Structure," International Journal of Science and Research, Vol. 5, Issue 7, pp.1355-1361, 2016
- [2] Khalid K. Shadhan, "OPTIMAL DIAGRID ANGLE TO MINIMIZE DRIFT IN HIGH-RISE STEEL BUILDINGSUBJECTED TO WIND LOADS," International Journal of Civil Engineering and Technology, Vol. 6, Issue 11, pp. 01-10, 2015
- [3] Ravish Khan and Sangeeta Khan, "Analysis of Diagrids Using Symmetric and Asymmetric Plan Geometry," International Journal of Recent Advances in Engineering & Technology, Vol. 4, Issue 3, pp. 9-13, 2016
- [4] Snehal S. Mali , D. M. Joshi and Roshni John, "Response of High Rise Building with Different Diagrid Structural System," International Journal of Science Technology & Engineering, Vol. 4, Issue 5, pp. 144-150, 2107
- [5] Chetan S.Pattar and Prof. Smt. Varsha Gokak, "ANALYSIS OF DIAGRID STRUCTURES WITH PLAN IRREGULARITY," International Research Journal of Engineering and Technology, Vol. 05, Issue 08, pp. 435-438, 2018
- [6] Irfan Saleem and Dr. Sunil Kumar Tengli, "Parametric Study on Asymmetric Diagrid Structures," International Journal of Applied Engineering Research, Vol. 13, pp. 61-66, 2018
- [7] Trupti A. Kinjawadekar and Trupti A. Kinjawadekar, "COMPARATIVE STUDY OF SEISMIC CHARACTERISTICS OF DIAGRID STRUCTURAL SYSTEMS IN HIGH RISE CONSTRUCTION," International Journal of Civil Engineering and Technology, Vol. 9, Issue 6, pp.315-323, 2018
- [8] Swaral R. Naik, Dr. Satish N. Desai and Malhar P. Naik, "EARTHQUAKE RESPONSES OF DIAGRID BUILDINGS ANDCONVENTIONAL MOMENT FRAME BUILDINGS HAVINGDIFFERENT H/B RATIO CONSIDERING SEISMIC NON-LINEAR TIME HISTORY ANALYSIS," International Journal of Civil Engineering and Technology, Vol. 9, Issue 13, pp. 1532-1539,2018
- [9] Akshat and Gurpreet Singh, "DYNAMIC ANALYSIS OF DIAGRID STRUCTURAL SYSTEM IN HIGH RISE STEEL BUILDINGS," International Journal of Civil Engineering and Technology, Vol. 9, Issue 8, pp.71-79, 2018
- [10] Trupti A. Kinjawadekar and Amit C. Kinjawadekar, "COMPARATIVE STUDY OF SEISMIC CHARACTERISTICS OF DIAGRID STRUCTURAL SYSTEMS IN HIGH RISE CONSTRUCTION," International Journal of Civil Engineering and Technology, Vol. 9, Issue 6, pp. 315-323, 2019

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