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Review of Structural Diagrid in Tall Building

M. Tech. Scholar Naveen Rewapati, Asst. Prof. Priyanka Dubey
Department of Structural Engineering
Dr. A.P.J. Abdul Kalam University, Indore
rewapatinav@gmail.com priyankadubey1105@gmail.com

***Abstract*- In the modern world due to overpopulation and decrease in the landmass in the cities the need to make high rise structure is now more prevalent than ever before and hence many solutions like outrigger, shear wall and diagrid are available in the structural stability of high rise. This paper deals with the previous research of on diagrids as an emerging alternative to control the lateral displacement in high rise.**

***Keywords*: Stiffness, High Rise, Structural stability, Diagrid, Pentagrid**

I. INTRODUCTION

The structural system of a high-rise building is designed to cope with the vertical gravity loads and lateral loads caused by wind or seismic activity. The structural system consists only of the members designed to carry the loads, all other members are referred to as non-structural. The term structural system or structural frame in structural engineering refers to load-resisting sub-system of a structure. The structural system transfers loads through interconnected structural components or members.

Tall building or high rise structures construction are more in this era; due to increase in population, economic prosperity and also due to the scarcity of lands high-rise structures are preferred. Height is main criteria in this kind of buildings, demand for tall buildings has increased because of increase in demand for business and residential space, advances in constructions, high strength structural elements, materials and also various software like Etabs, Staad pro etc these are analysis and design software's have provided growth of high rise structures.

1. Diagrid Structural systems

Diagrid is a particular form of space truss. It consists of perimeter grid made up of a series of triangulated truss system. Diagrid is formed by intersecting the diagonal and horizontal components. Diagrid has good appearance and it is easily recognized.

The configuration and efficiency of a diagrid system reduce the number of structural element required on the façade of the buildings, therefore less obstruction to the outside view. The structural efficiency of diagrid system also helps in avoiding interior and corner columns, therefore allowing significant flexibility with the floor plan.

II. RESEARCH FINDING

Kyoung Sun Moona (2011 Diagrid structures are prevalently used for today's tall buildings due to their structural efficiency and architectural aesthetic potentials. This paper studies structural performance of diagrid systems employed for complex-shaped tall buildings such as twisted, tilted and freeform towers. For each complex form category, tall buildings are designed with diagrid systems, and their structural efficiency is studied in conjunction with building forms.

In order to investigate the impacts of variation of important geometric configurations of complex-shaped tall buildings, such as the rate of twisting and angle of tilting, parametric structural models are used for this study. Based on the study results, design considerations are discussed for the efficient use of diagrid structures for complex-shaped tall buildings. the rate of twisting and angle of tilting, parametric structural models are used for this study. Based on the study results, design considerations are discussed for the efficient use of diagrid structures for complex-shaped tall buildings.

Khushbu Jani et al (2013) Advances in construction technology, materials, structural systems and analytical methods for analysis and design facilitated the growth of high rise buildings. Structural design of high rise buildings is governed by lateral loads due to wind or earthquake. Lateral load resistance of structure is provided by interior structural system or exterior structural system.

Usually shear wall core, braced frame and their combination with frames are interior system, where lateral load is resisted by centrally located elements. While framed tube, braced tube structural system resist lateral loads by elements provided on periphery of structure. It is very important that the selected structural system is such that the structural elements are utilized effectively while satisfying design requirements. Recently diagrid structural system is

adopted in tall buildings due to its structural efficiency and flexibility in architectural planning. Compared to closely spaced vertical columns in framed tube, diagrid structure consists of inclined columns on the exterior surface of building. Due to inclined columns lateral loads are resisted by axial action of the diagonal compared to bending of vertical columns in framed tube structure.

Diagrid structures generally do not require core because lateral shear can be carried by the diagonals on the periphery of building. Analysis and design of 36 storey diagrid steel building is presented. A regular floor plan of 36 m × 36 m size is considered. ETABS software is used for modeling and analysis of structural members. All structural members are designed as per IS 800:2007 considering all load combinations. Dynamic along wind and across wind are considered for analysis and design of the structure. Load distribution in diagrid system is also studied for 36 storey building. Similarly, analysis and design of 50, 60, 70 and 80 storey diagrid structures is carried out. Comparison of analysis results in terms of time period, top storey displacement and inter-storey drift is presented in this paper

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Niloufar Mashhadiali et al (2013) Hexagrid structure is an innovative tube-type system. It is constructed with hexagonal exterior structural grids. The hexagrid works as an effective lateral and gravitational resisting system. This paper presents the progressive collapse-resisting capacity of this new system and the common diagrid system based on the local failure of the structural elements in the story above the ground. The collapse behavior is evaluated by two different nonlinear static and dynamic analysis methods. This study was conducted to design two-type 28-story and 48-story building models to withstand wind load for both structural systems.

With the analytical results, the hexagrid has enough potential of force redistribution due to its special configuration. It is observed that the new system had high resistance to progressive collapse than diagrids in similar condition. The complementary studies illustrate that resisting progressive collapse capacity, in both hexagrid and diagrid structures, is increased by using the buckling-restrained elements.

Ravi Sorathiya et al (2017) Construction of multi- storey building is rapidly increasing throughout the world. . Recently the diagrid structural system has been widely used for tall buildings due to the structural efficiency and aesthetic potential provided by the unique geometric configuration of the system. These days the latest trend of technology in diagrid structures is evolving. The diagrid structures are buildings with diagonal grids in the periphery at a particular angle and in modules across the height of the building. Diagrid structure uses triangulated grids which are in place of vertical columns in the periphery. Thus, systems that are more efficient in achieving stiffness against lateral loads are considered better options in designing tall buildings. This paper presents a stiffness-based design methodology for determining preliminary member sizes of r.c.c diagrid structures for tall buildings. A G+24, G+36,G+48,G+60 storey RCC building with plan size 18 m × 18 m located in surat wind and seismic is considered for analysis. STAAD.Pro software is used for modeling and analysis of structural members. All structural members are designed as per IS 456:2000 and load combinations of seismic forces are considered as per IS 1893(Part 1): 2002. Comparison of analysis results in terms of beam displacement, Storey Drift, Bending Moment. This cause economical design of diagrid structure compared to conventional structure.

III. CONCLUSIONS

1. Diagrids are good structural arrangements for complex structure which are varying and irregular in elevation.
2. Diagrids are also good in resisting progressive collapse of multistory structure.
3. Diagrids in the form of triangulated grids imparts maximum lateral resistance.

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