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# PRELIMINARY DESIGN METHODLOGY OF DIAGRID STRUCTURAL SYSYTEM

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**Abstract**

Diagrid structural system is a particular form of tubular systems, which exterior columns replaced by diagonal members. This system contained of diagonal truss elements through the height of the structure. The stability and shear rigidity of diagrid system is due to axial performance of diagonal elements. This paper controls a simple methodology for analyzing the internal forces arising in the single diagrid module due to vertical and horizontal loads, the resisting mechanism of diagrid structures under gravity and earthquake loads is described. The methodology is applied to a diagrid structure. To this end, a ۳٦-stroey diagrid structure without corner columns was designed, and then a comparative analysis carried out. The angle of diagonal elements through the height of the structure is considered ٦۷,۳۸ degrees and the plan of structure is square. Internal forces due to gravity and lateral loads in diagrid elements showed enough correspondence between finite element analysis and hand calculation. The results showed that this methodology is useful for preliminary design and accessing the internal forces.

**Keywords: Diagrid structure, preliminary design, gravity load, lateral load, uniform angle**

## ۱. INTRODUCTION

In recent years, there has been an increasing interest in diagrid tube system. Diagrid system is a particular form of space truss. It consists of diagonal elements through the height of the structure. Diagrid structural systems are evolution of braced tube systems, by this difference that, in diagrid system vertical columns are removed and the stability of the structure is provided by the axial performance of diagonal elements. Diagrid is not a new structural system. An early example of diagrid structure is the ۱۳ story IBM building in Pittsburg that was completed in ۱۹۶۰.

In diagrid structural system both shear and moment rigidity provides by axial performance of diagonal elements. Thus, it causes to reduce the internal columns. Perimeter diagonal elements in diagrid system are carried both gravity and lateral loads. This system also allows for the building with complex and curved configuration. Some examples of tall buildings with diagrid system are The Capital gate tower in Abu Dhabi and the Tornado tower. Furthermore, the diagrid system is constructed with and without corner columns.

Leonard [۱] studied the influence of shear lag on tall buildings with diagrid system. Some investigations are made by Moon [۲], Kim and Lee [۳] to estimate the optimal angle of diagrid system. Moon *et al.* [۲] developed a simple design methodology for determining preliminary design sizes for diagonal elements. Toreno [۴] presented a methodology to assess the axial forces of diagonals. Design studies are also carried out for diagrids of varying angles through the height of the structures by Moon [۵], [۶] and Zhang [۷]. Recently, some investigations have done to evaluate inelastic seismic performance of diagrid tube structures by Kim and co workers [۸], Kim and Lee [۹]. Furthermore, the progressive collapse behavior of diagrid tube is investigated by Kim and Lee [۹], Kim and Kong [۱۰].

The purpose of this paper is to control a simple methodology for analyzing the internal forces causes in the single diagrid module due to gravity and lateral loads. According to this methodology, the behavior of the triangulated elements is discussed.