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Structural Performance of High Rise Building with Outrigger System: A Review

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Abstract: *In India, the tall building has always been a vision of dreams and technical progress, leading to the progress of the world. Currently, with rapidly growing urbanization, the tall building has become a more convenient option for office and residential housing. Tall buildings are usually designed for residential, office or commercial use. They are primarily a reaction to the rapid growth of the urban population and the demand for business as close to each other as possible. Much of India is prone to damage to seismic hazards. Therefore, it is necessary to take into account the seismic load to design the design of the height design. The present work deals with the literature review related to high rise building with outrigger system.*

Keywords: RC frame, Outrigger, STAAD

I. Introduction

A tall building like a skipping rope has always been a vision of dreams and technical progress with new types of equipment leading to the progress of construction in the world. To date, the Tall building has become a more convenient option for residential and commercial housing due to the rapid growth of urbanization. Tall buildings are designed for residential and office use. This is the main reaction to the rapid growth of the urban population and the demand for business. Much of our country is prone to damaging seismic hazards due to earthquakes. Therefore, it is necessary to take into account the seismic load to design the altitude structure. Various side load resistance systems are used in the high-rise building. These lateral forces can create critical stresses in the structural and non-structural element in construction, causing unwanted stresses in the structure, and unwanted oscillations or cause excessive lateral oscillations of the structure.

Figure 1: MNP Tower in Vancouver BC

In recent years, it was believed that the building members of the building carried primarily gravitational loads. However, today, due to advances in structural systems and high-strength materials, the weight of the building has decreased, in turn increasing the slenderness, which requires taking into account mainly lateral loads such as wind and earthquake. In particular, for tall buildings, as slimness, rigidity and flexibility are important parameters, as buildings have been severely affected by side loads resulting from wind loads and earthquake loads. Thus, it becomes more important to determine the appropriate structural system for side load resistance depending on the height of the building. There are many types of structural systems that can be used to side-resist tall buildings.

II. Literature Review

A S Jagadheeswari et al [1] studied the Response spectrum analysis gives smaller results compared to Static analysis, there is reduction of about 24% in values. This clarifies, the ESA gives higher results and safe which will be sufficient while analyzing buildings of low rise and less importance. The storey drift values will always be in concurrence with the displacement values. The higher drift values are noticed in model 1 and lower in case of model 3. It can notice few dips in the graph, which indicates the presence of stiffener element, outrigger system. The time period of the model 1 is high due to the flexibility in the structure. However, the model 3 behaves stiffer, hence the time period is less. These buildings exhibit stiffness and stableness and also will show better performance towards the seismic analysis. The base shear values are almost same in the all the models. The base shear depends on the mass, height and dynamics of the building. However, It can observe there is an almost equal mass and height of building, the models do not make much difference. Therefore, it can be concluded that the provision of the outrigger system will not change in the base cost of the shift, as it depends purely on the mass, height and dynamics of the building.

Abbas Hagollahi et al [2] studied the development of a tall building that is growing rapidly around the world. In the typical practice of structural design, the performance of systems that withstand lateral loading is the main direction of lateral analysis. Structural outrigger systems are one of the systems that withstand lateral loading, which can provide significant drift control for tall buildings. The study is conducted on a 30-storey multi-storey wall. For analysis, the usual floor plan of 38.5 m x 38.5 m is considered. Two types of analysis are conducted, namely time history analysis and analysis. To obtain the results, the parameter - the maximum displacement of the floor is taken into account. In this paper, the results of various outdoor design systems were analyzed using ETABS software.

Abdul Karim Mullah et al [3] investigated the behavior of an outrigger with and without a system of belt farms, studied in both symmetrical and asymmetric structure. It has been studied that an outrigger with a system of belt farms is effective in controlling the drift of a building. Even in the asymmetric structure, drift is controlled to the maximum. Thus, outrigger systems with belt farms improve the performance of the building by resisting the side forces.

Alpana L. Gawate et al [4] investigated minor changes in the construction time and base shift of the building. The outrigger system as sliding walls on the periphery of the building on 8-m, 16th and 24th floors reduces movement by 4.5 %. There is also a reduction in the construction period by 5 % and a baseline shift by 8 %. The optimal type of exposure is model V, ie. Building with outer X-tart on 8-m, 16th and 24th floors)

Alpana L. Gawate et al [5] investigated the use of an outrigger system in high-rise buildings, increasing rigidity and making the structural form effective at lateral loading. X Weaving and sliding walls as certain shelter floors can be used as transportation systems. The outrigger system as an X-tightener on the periphery of the building on the 12th and 24th floors reduces the volume of the upper floor by 4.5 %. There is a slight change in the construction period and the basic shift of the building. The outrigger system as sliding walls on the periphery of the building on the 12th and 24th floors reduces the volume by 3.5 %.

S. D. Hoenderkamp [6] studied five 60-storey three-dimensional models are subjected to earthquake load, analyzed and compared to detect a decrease in lateral displacement associated with the location of the outrigger and belt system. For the 65-storey 40-storey model %, the maximum reduction in displacement can be achieved by providing the first outrigger in the upper and second outriggers in the middle of the design height. For a three-dimensional 60-storey structural model that has been subjected to an earthquake load, approximately 18 % reduction of maximum displacement can be achieved by optimally locating outrigger farms located at the upper and 33rd levels.

The Council and others [7] concluded that an outrigger system was proposed in this study to improve the performance of a building under seismic load. This paper contains a comparative study of regular construction with outrigger and improper construction with and without it with centralized rigid wall and steel mounting as a revelation.

III. Conclusion

This work concerns the review of the literature on the outrigger system. Various scientific works are studied, and it is observed that all structural weight can be reduced due to the significant lateral strength of the system. Therefore, it is the most common structural system for tall and prenatal buildings built in recent years.

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