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Earthquake Analysis in Complex Shape Building Using STAAD PRO

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ABSTRACT

This research delves into the seismic analysis of a G+10 storey building designed with a cross-shaped configuration. Utilizing STAAD PRO software and employing linear static analysis, various seismic parameters such as displacement, story drift, modal time period, and frequency were meticulously examined. The primary objective was to assess the seismic response of the cross-shaped structure in comparison to other configurations with an equal surface area. Results unequivocally indicate that the cross-shaped building exhibits heightened stability, showcasing superior performance in seismic conditions. This finding underscores the structural robustness of the cross-shaped configuration in earthquake-prone regions. The study also sheds light on specific characteristics of the cross-shaped building, offering valuable insights for seismic-resistant design strategies. Through a meticulous investigation focused solely on the cross-shaped structure, this research contributes to the broader understanding of earthquake analysis in complex buildings, serving as a foundation for future advancements in structural engineering.

Keywords : Complex shape building, displacement, equivalent static force method, frequencies, modal time period, overturning moment, story drift, story shea

I. INTRODUCTION

Structural analysis is basically used for determine the behavior of a structure when subjected to loads. The load may be load due to the weight of things such as people, furniture, etc. or due to dynamic loads as wind, explosions and an earthquake. Hence, it is necessary to take into consideration the seismic load in the design of structures.

The seismic response of the building systems shows a large dependence on the type of analysis method adopted. There are basically two methods for seismic Analysis of buildings which are given as follows:

1) Equivalent Static Method

Equivalent static analysis method is only suitable for the design and analysis of small structure.This method considers only one mode for each direction. Static method has a drawback as it uses only one mode of vibration of building There are several factors on which design horizontal coefficient depends such as zone coefficient, seismic weigh, importance of the structure, fundamental natural time period and response reduction factor.Static approach is based on replacing concept of the inertia forces at various considerable masses.

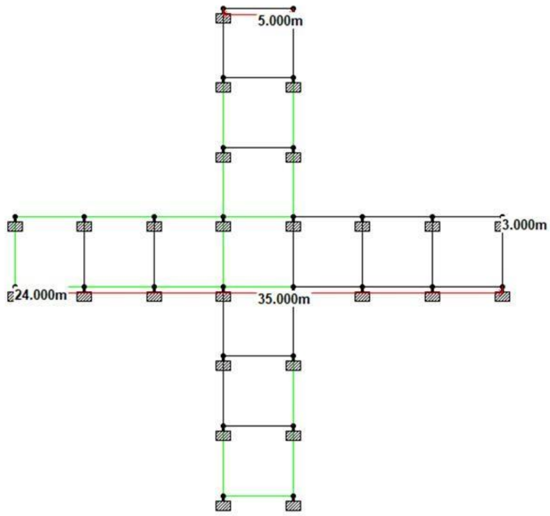
2) Response Spectrum Method

The response spectrum represents an envelope of upper bound responses, based on several different ground motion records.This method is an elastic dynamic analysis approach that relies on the assumption that dynamic response of the structure maybe found by considering the independent response of each natural mode of vibration and then combining the response of each in same way.This is advantageous in the fact that generally only few of the lowest modes of vibration have significance while calculating moments, shear and deflections at different levels of the building

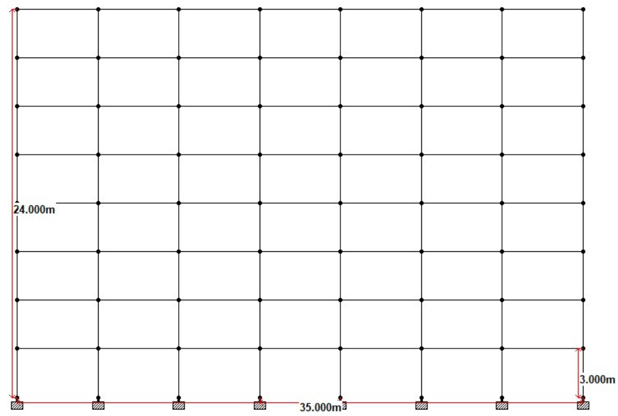
II. METHODS AND MATERIAL

Literature Survey is carried out of various papers and objectives of project are finalized.A G+7 RCC Storey building is selected and modelling is carried out using Staad Pro Software.Framing layout and dimensions of buildings are finalized. Analysis of building is being performed in different earthquake zones. The results are extracted and Conclusions are drawn.

Plan View

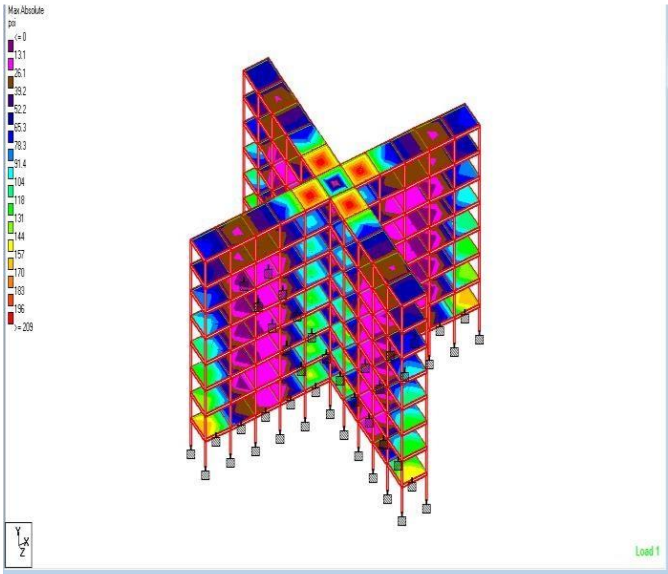


Elevation View

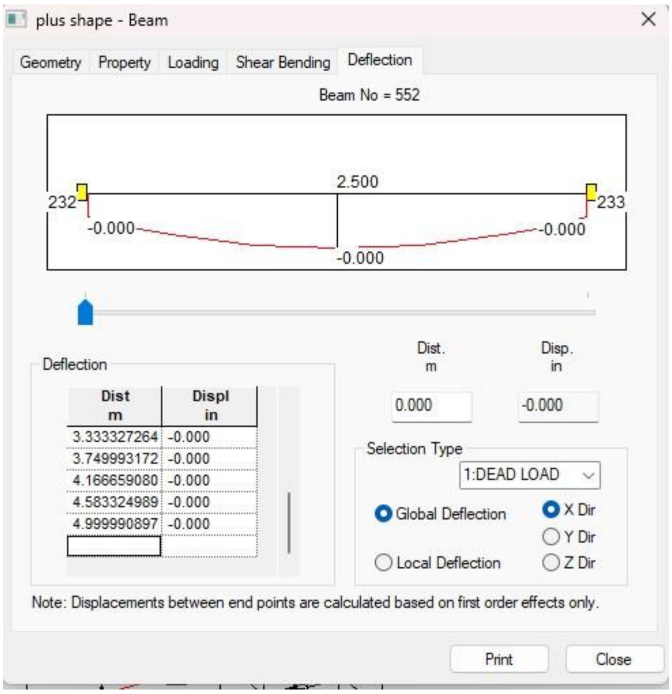


Complex Shapes can be designed to efficiently distribute loads, making them more resistant to structural issues. Irregular shapes may disperse forces more evenly, reducing stress concentrations.Complex shapes provide better earthquake resistance they can disrupt the propagation of seismic waves, reducing the buildings vulnerability to ground motion.Certain complex shapes can incorporate redundancy in their design, meaning that if one part fails, there are backup load paths to maintain structural integrity this feature is very useful in case of earthquakes as there are chances of failure of some part of structure during seismic activity.The response spectrum method accounts for the dynamic nature of seismic forces considering how ground motion varies with time. This provides a more realistic representation of earthquake effects.

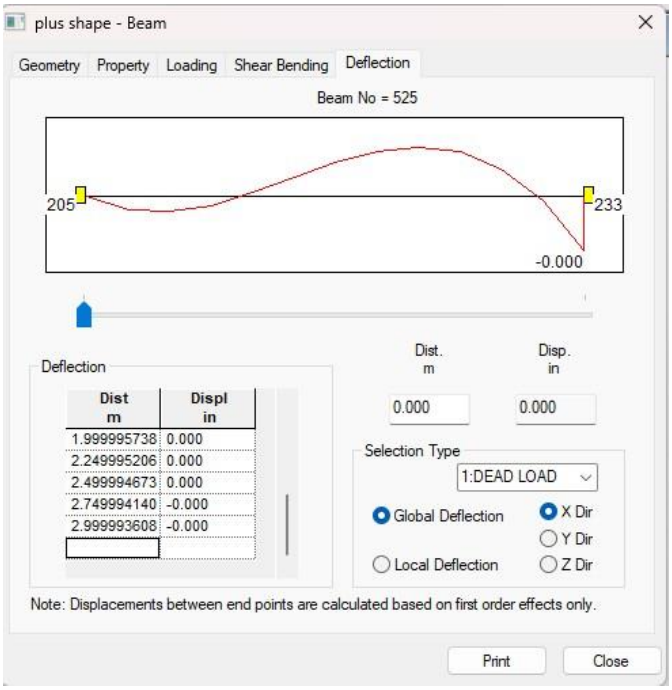
It takes into account the mode shapes and natural frequencies of the structure which allows for a more accurate assessment of how different parts of building respond to seismic forces.The response spectrum method can be applied in multiple directions, considering ground motion in different directions simultaneously. This is particularly important for structures in regions with complex seismic activity.



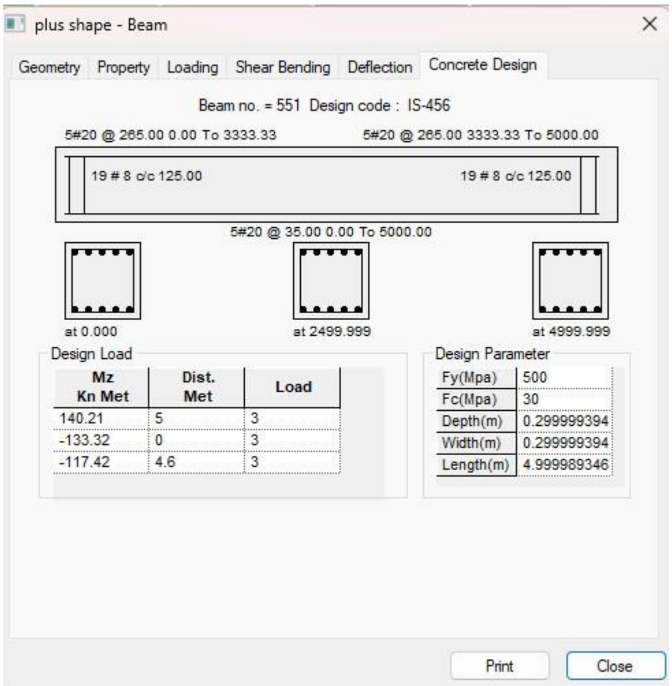
Deflection of Beam



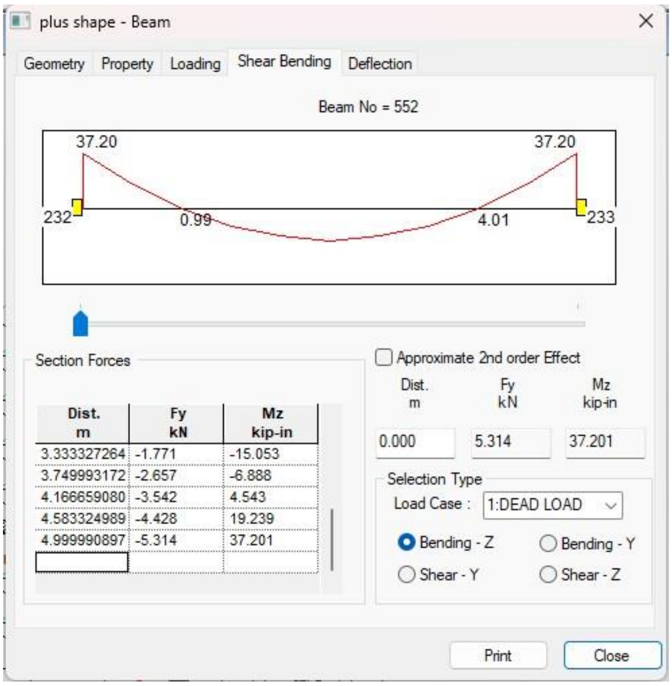
Deflection of Column



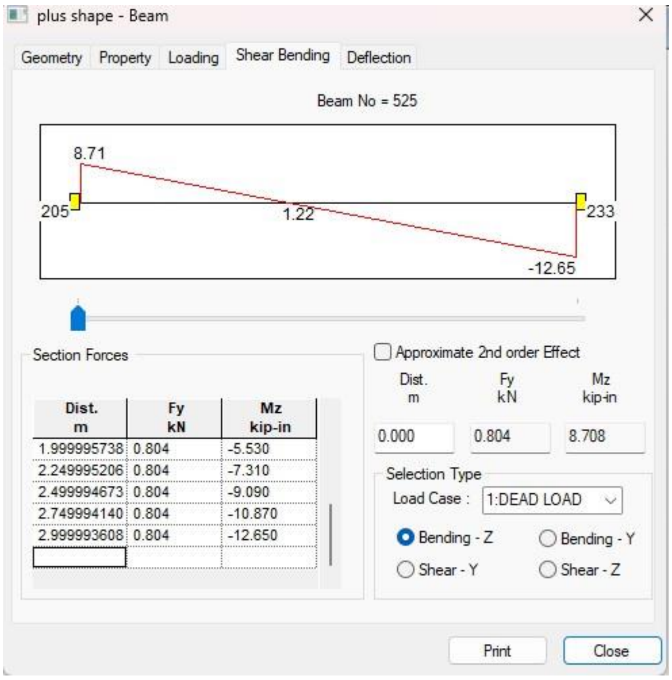
Reinforcement detailing of Beam



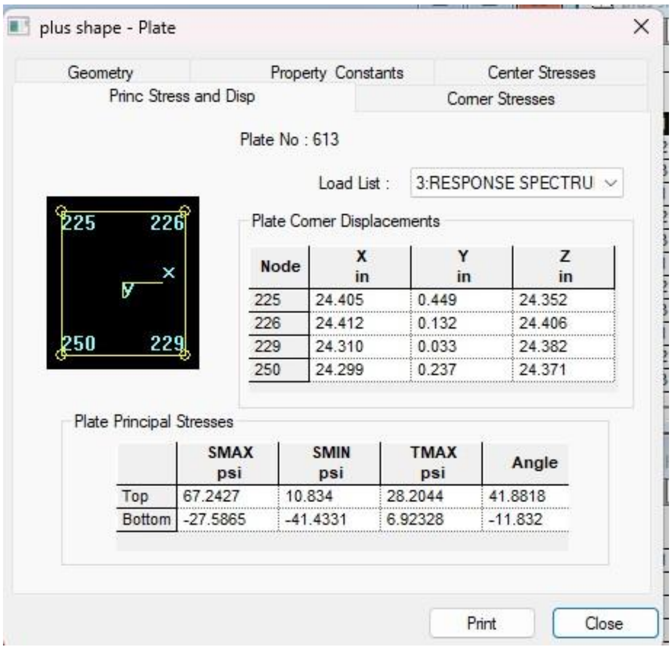
Shear Bending of Beam



Shear Bending of Column



Detailing of Plate



III.CONCLUSION

In summary, this research introduces a streamlined modelling approach for seismic analysis of reinforced concrete walls, offering an efficient alternative to more computationally demanding methods involving shell elements. The findings emphasize the effectiveness of the proposed strategy, particularly in the context of a cross-shaped building designed for earthquake analysis using STAAD PRO. Notably, static analysis for tall structures tends to yield higher results, prompting the recommendation for dynamic analysis to ensure both effective and economical structural design. The specific focus on the cross-shaped building underscores its superior seismic performance compared to other shapes, affirming its resilience. Additionally, the analysis reveals that the cross-shaped structure is more rigid than other configurations, contributing valuable insights for earthquake-resistant design in complex buildings.

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