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Analysis of a Prefabricated Structure Considering Lateral Load Using ETABS A Review

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ABSTRACT

Precast concrete is an alternative to cast-in-situ concrete. While cast-in-situ concrete is cast in its actual location, precast concrete is cast at another location, either at the building site or in a factory, and is then lifted to its final resting place and fixed securely. This means that unlike cast-in-situ construction, which is monolithic or continuous, precast concrete buildings are made of separate pieces that are bolted or connected together. In India, greatest constructional exercises are finished utilizing the old conventional cast in situ strategies since seemingly forever. As the nation is creating in a high speed, the necessity for lodging is heightening and in this way the development ventures are additionally blossoming quickly henceforth requesting quicker and better development techniques. This expanded interest can be coordinated by utilizing one of the cutting-edge innovations, pre-projected substantial strategy. Investigation of writing shows various priority of precast constructional strategy over different techniques for development.

Keywords: Conventional Cast in Situ Method, Etabs, Pre-Cast Concrete Method, Seismic Analysis

I. INTRODUCTION

Construction is an important activity that has to be done very carefully. In present scenario there is a large need for housing. So it has to be completed at some faster rate without affecting the cost. But with the conventional construction the speed cannot be achieved. So we opt for some other methods of construction. Precast construction is one of the method by which the total time of construction can be minimized. Precast construction has its own advantages such as it reduces the construction time; the erection is easy etc. But still in countries like India there is a hesitation to accept the precast technology. The concept of precast (also known as "prefabricated") construction includes those structures where the majority of structural components are standardized and produced in plants in a location away from the building, and then transported to the site for assembly. Many precast

components have thinner cross sections than that cast in place concrete. For Precast structures there must be conscious effort to ensure the structural continuity such as slabs, beams and columns are connected effectively. All structural elements forms stable structural system after the joints is connected. Seismic performance of the prefabricated structure can be increased by providing precast shear wall. An introduction of shear wall represents a structurally efficient solution to stiffen a building structural system because the main function of a shear wall is to increase the rigidity for lateral load resistance. . They are vertical components of the structure i.e. the horizontal force resisting system. They are made to counteract the result of lateral masses engaged on the structure. In residential construction, shear walls are straight external walls that usually provide all of the lateral support for the building. The design approach adopted in the Indian Code IS 1893(Part I): 2002 „Criteria for Earthquake Resistant Design Of Structures" is to ensure that structures possess at least a minimum strength to withstand minor earthquake occurring frequently, without damage; resist moderate earthquakes without significant structural damage though some non-structural damage may occur; and aims that structures withstand major earthquake without collapse. Reinforced concrete (RC) buildings often have vertical plate called Shear Walls. These walls generally start at foundation level and are continuous throughout the building height. Their thickness can be as low as 150mm, or as high as 400mm in high rise buildings. Shear walls are usually provided along both length and width of buildings. Shear walls are like vertically-oriented wide beams that carry.

II. LITERATURE REVIEW

Adesh Thakare and Salman Shaikh (2022) objective of the research paper was to conduct a comparison study using STAAD-PRO software on seismic analysis of RCC and precast construction of high-rise residential buildings (G+10). The primary goal was to present the changes that occur in both the structure and the results in a high seismic zone. The comparison was made on parameters of time frame, structure dynamics as per modes, Base shear and storey drift. As compared to RCC, Precast Structure is not fully constructed by precast components, as IS 1893 also does not give the assurance for precast connection to construct in high seismic zones. In short, Indian code is not yet available for precast structure design. Comparatively the time taken to complete one cycle of oscillation for Precast structure as compared to RCC is more, at first mode it is 3.12 sec in case of Precast building and 1.62 for RCC. The Flexibility of the Precast Building is increased by considering the Joints as semi-rigid.

Aman Agrawal et.al (2021) research paper presented the examination and plan of g+5 floor precast concrete structure and traditional cast-in-situ structure. The designs were demonstrated and investigated utilizing Etabs programming for dead, forced, and seismic load for load combinations. The fundamental intention was to consider the conduct of both the sorts of structures under the previously mentioned loads and load mixes. Examination was directed dependent on different components like external loads, greatest deflections, most extreme story drifts, mode shapes, timeframes, frequencies and base shear. Results stated that precast structure has higher time span as contrast with normal design. The mass cooperation factors (%) and time-frame for both the structures for initial six predominant modes were introduced. Graphical portrayal against story shear versus story height shows the joined qualities acquired in x and y heading. The acceleration spectrum esteem was 0.0801 for outlined design as ordinary concrete structure and 0.1000 for precast concrete construction, i.e, the story shear was multiple of acceleration spectrum esteem and the seismic load of the structures.

Shubham Tiwari and Manas Rathore (2021) objective of the research paper was to analyze the behavior of the precast structure for the applied loads. Planning of the G+7 structure was done using Auto CAD software and analysis was performed using analytical application ETABS. Precast structures have minimum C35 grade of concrete, all the component and properties or sections was given to the structure. Slabs are membrane elements in Etabs; that transfer load through one-way

Xiaomeng Zhang et.al (2021) author proposed a new box structure system where the precast walls and floor slabs are firmly connected through the connection of cast-in-place nodes to form a box structure system. A new prefabricated concrete wall composed of a new type of double-groove precast concrete wall panels was presented. Through the finite element analysis of the mechanical performance of the wall, the ultimate bearing capacity of the wall and the related failure mechanism were obtained, which laid the foundation for further research.

Gang Yao et.al (2020) The development obstacles of the prefabricated concrete building were presented and relevant suggestions were provided. The development status of prefabricated concrete buildings, production base of prefabricated components, price of precast concrete, and the scale of building construction industry were analyzed. Results showed that the production base of prefabricated component is reasonably laid out by forming a radiation circle with the reasonable radius. The price of the prefabricated component is controlled by the average reduction of 1039.8 yuan/m3 , and the proportion of prefabricated concrete buildings is adjusted by an increase of 8% to 10% per year. This can promote the development of prefabricated concrete buildings in Chengdu. The incomplete standardization system is the most serious development obstacle, and the establishment of local standards is an effective development proposal.

Jai Srivastava and Chandan Kumar Gupta (2020) in the research paper, finite element software was done to analyze the precast prestressed panel supported as a wall panel and the results were compared with technical data available. The precast prestressed slab panel was checked for the incremental increase in point load and the pattern of crack stress was recorded. The model prepared in ANSYS shows the same pattern of crack and same load deflection curve. Finite element method reveals the accurate and efficient method to analyse the structural members. Finite element analysis software should be used which saves time and best stimulation can be done. This saves the design time and avoid long mathematical calculations.

Aswathi V.K and Dona Chacko (2019) author aimed to compare the effectiveness of shear wall at different locations in a prefabricated structure and the parameters for comparison were storey displacement and storey drift. The modelling and analysis was performed using analytical application ETABS. Conclusion stated that storey drift decreases with the provision of shear wall. By providing shear wall at different location in a prefabricated structure storey drift decreases when it compared with structure without shear wall. Shear wall located at corner in L shape gives better performance and rigidity to the prefabricated structure in both G+12 & G+2.That is in a prefabricated structure effectiveness of shear wall is obtained at corner in L shape.

Priya Singla and Ravikant Kumar (2019) author investigated the effect of modeling of the vertical joints between the wall panels in a precast emulative wall system building in the research paper. Objective was to formulate a structural system which can adequately resist loads due to gravity, wind and earthquake with maximum efficiency. The project was a residential building with ground floor plus 19 storeys above ground. The building construction was envisaged maximizing the utilization of precast construction method. This report summarizes the

design philosophy, primary assumptions, methods of analysis / design. Results stated that lateral stiffness of storey shall not be less than 80% of storey above. As building is assumed in Zone 2, so according to clause the model mass participation of first three modes is greater than 65%. As per tall building code 16700 (clause no 5.1.2) the height of building is 59.0 m and the width of building is 21.59 m so ratio of (H/B) is 2.73which is less than 10 as marked in the above table. As per tall building code 16700 (clause no 5.2.2), the length of building is 28.92 m and the width of the building is 21.59 m so their ratio is 1.33 which is less than 5.

U.R. Tallapalem et.al (2019) in the research paper, the three types of Beam-columns connections such as Rigid connection ,semi-Rigid connection and Hinged connections were developed in G+20 High rise building. These High rise building were analysed with help of Time history analysis of High Seismic waves, Moderate Seismic waves and Low seismic waves. It helps to Identify the behaviour of connections and The results of Top Displacements , story Drifts and Inter storey Drifts are compared for the Different connections and Different Seismic waves.

III. CONCLUSION

Here author stated that the utilization of these methods can stabilize the structure promptly.

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