Original Article
International Journal of Scientific Research in Civil Engineering
Available online at : www.ijsrce.com
© 2023 | IJSRCE | Volume 7 | Issue 5 | ISSN : 2456-6667

Analysis of a Prefabricated Structure Considering Lateral Load Using ETABS

Nitin Kukreja[1], Mr. Pradeep Kumar Nirmal[2]
P.G. Scholar[1], Assistant Professor[2]
RSR Rungta College of Engineering and Technology, Madhya Pradesh, India

ARTICLEINFO

Article History:
Accepted: 01 Sep 2023
Published: 10 Sep 2023

Publication Issue
Volume 7, Issue 4
September-October-2023

Page Number
14-19

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

Objectives of the Research

- To carried out detailed study of the effectiveness of shear wall on prefabricated structure.
- To determine the deflection and the storey drift occurred in the precast structure with different location of shear wall.
- To study as well as compare the seismic response of G+11 Prefabricated building for optimum location of shear wall so that we can select the best possible ways construction in earthquake zone
- To compare the cost and time of precast construction vs conventional construction.
- To determine the type of construction that would reduce the construction cost.

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.

III. METHODOLOGY

Steps of the Modelling and Analysis

Step 1: Research paper from different authors was summarized in this section who have focused towards analyzing multi storey high rise structures considering seismic loads with different zones and soil condition

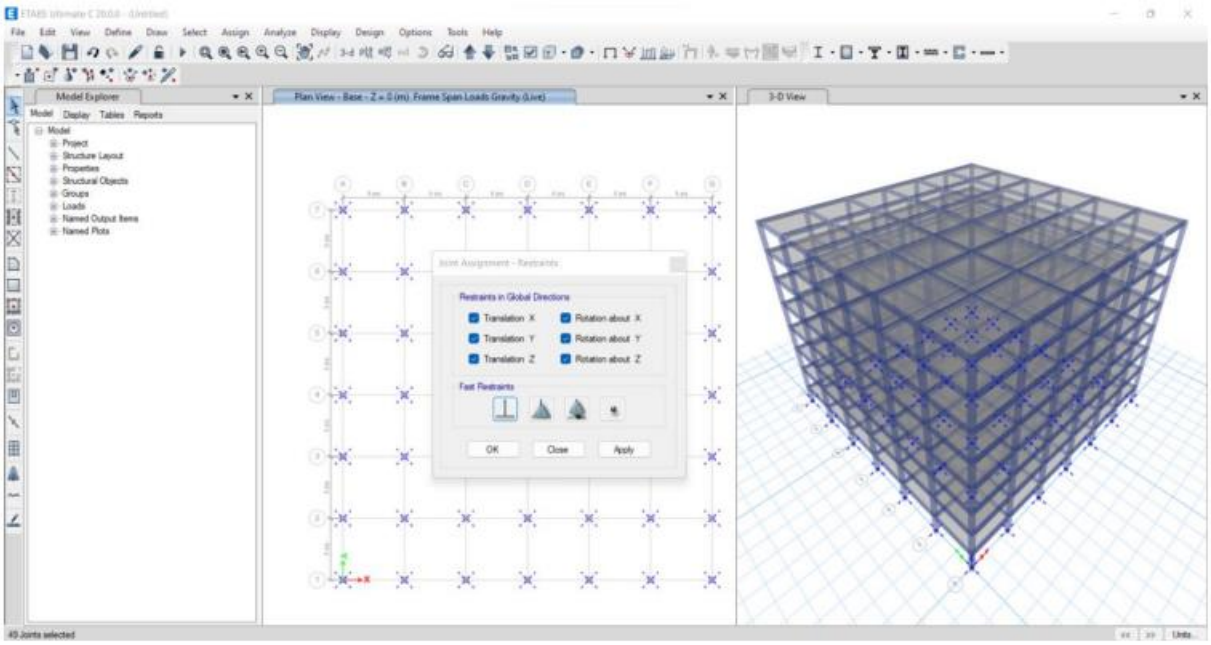
Step 2: In order to initiate the modelling of the case study, firstly their"s need to initialize the model on the basis of defining display units on metric SI on region India as ETABS supports the building codes of different nations. The steel code was considered as per IS 800:2007 and concrete design code as per IS 456:2000.

Step 3: ETABS provides the option of modelling the structure with an easy option of Quick Template where the grids can be defined in X, Y and Z direction

Step 4: Next step is to define the material properties of concrete and steel. Here in this case study, green concrete and rebar HYSD 550 is considered and its predefined properties are available in the ETABS application

Step 5: Defining section properties for Beam, Column. Beam size of 350x300mm, Column size of 400x400mm and Slab size of 200 mm is considered in the study

Step 6: Assigning Fixed Support at bottom of the structure in X, Y and Z direction in both the considered cases.

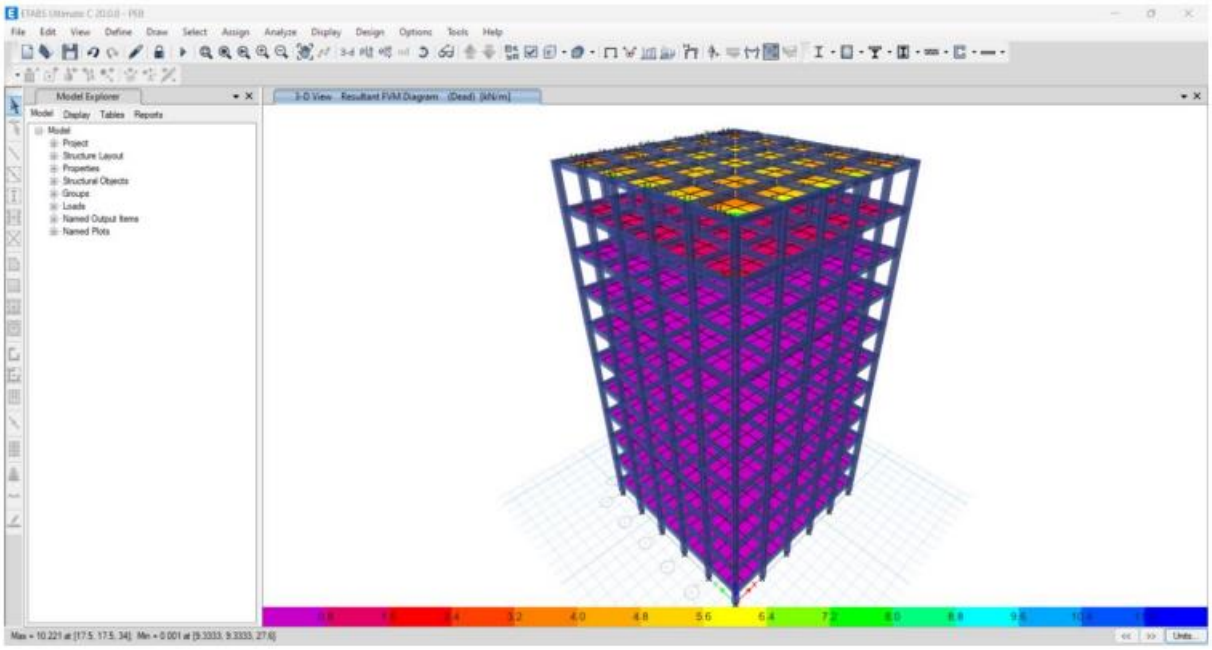


Step 7: Defining Load cases for dead load, live load and seismic analysis for X and Y Direction.

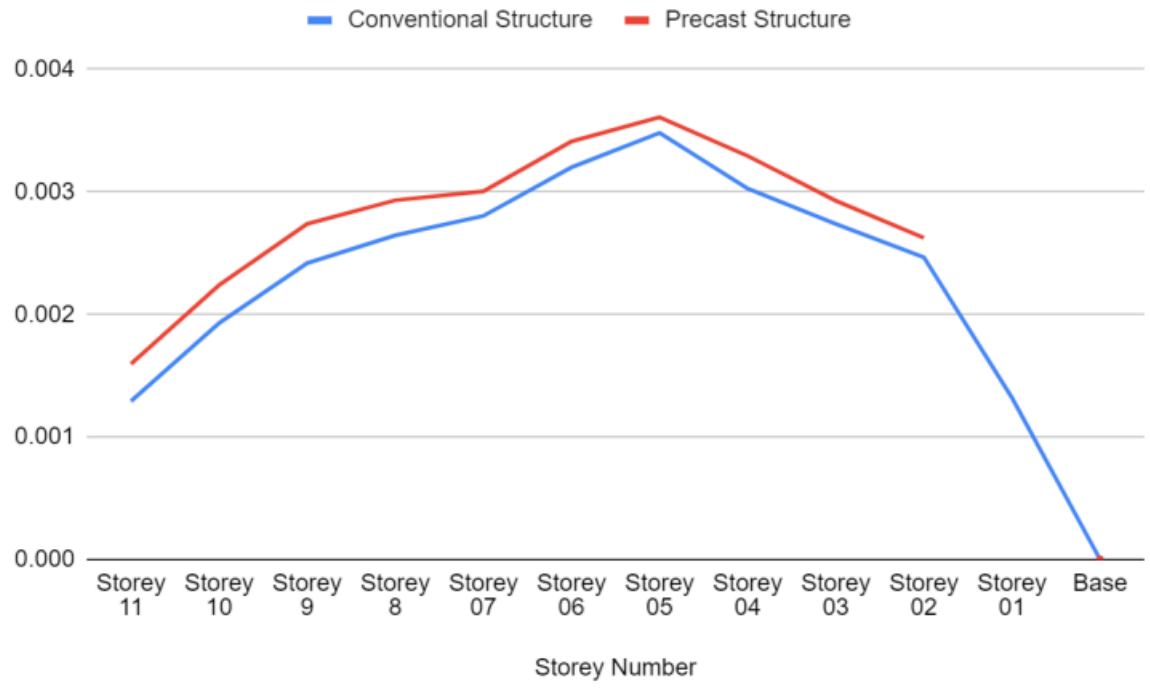
Step 8 Defining Seismic Loading as per IS 1893: 2016 Part I

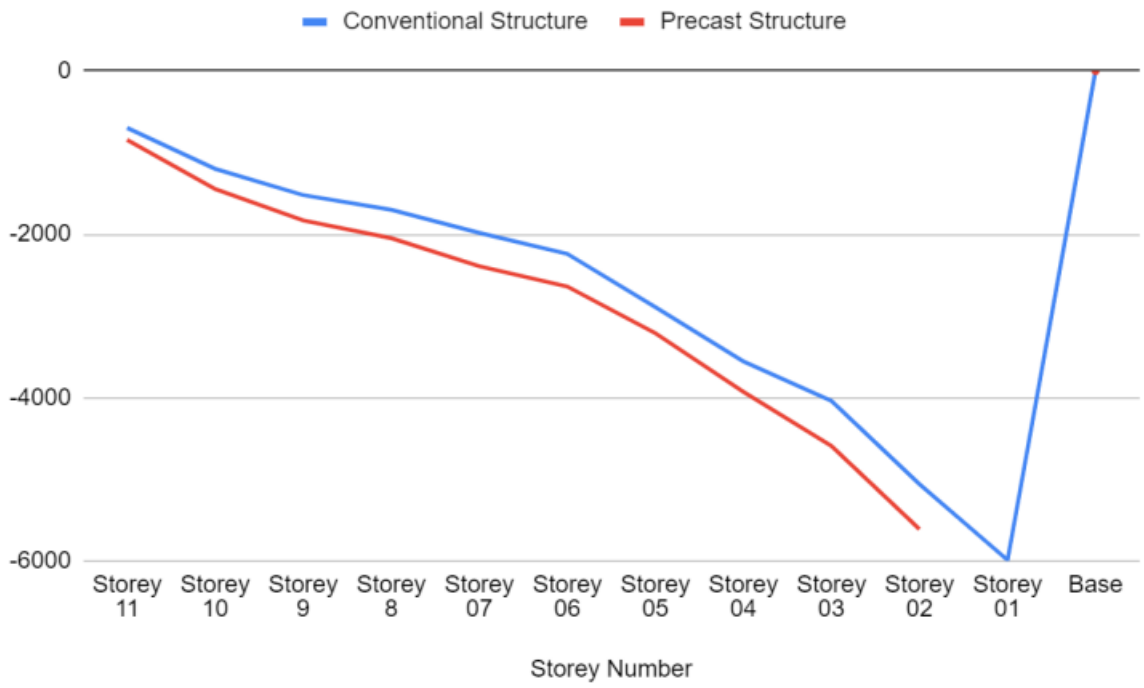
Step 9: Conducting the model check for both the cases in ETABS

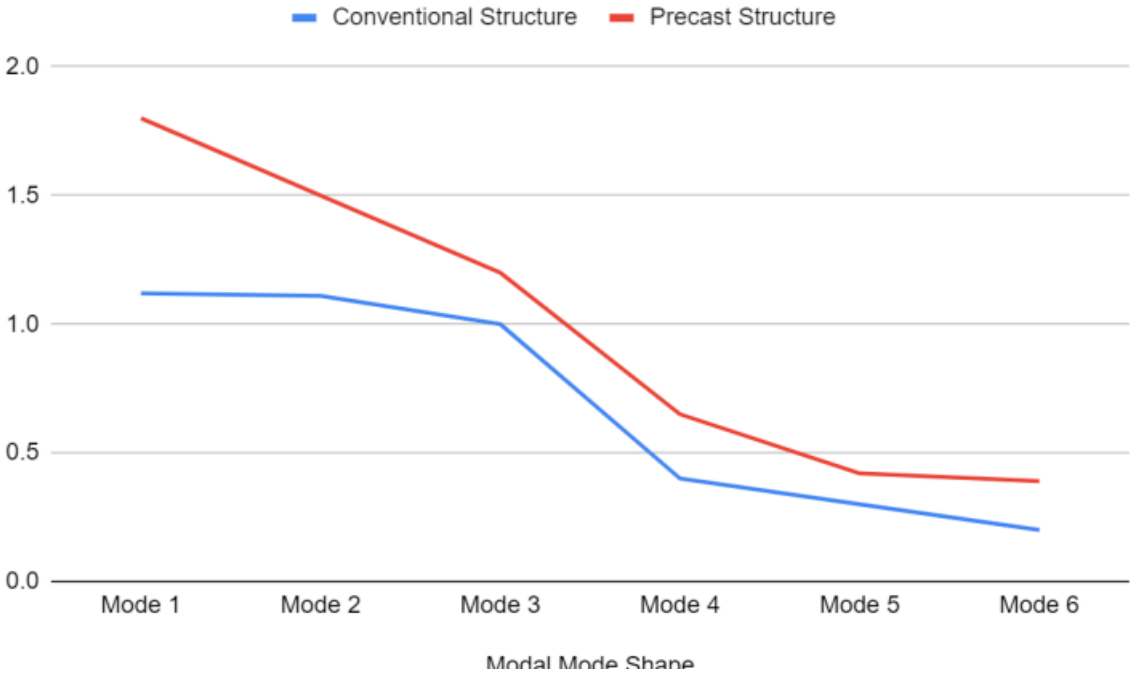
Step 10: Analyzing the structure for dead load, stress analysis and displacement.



IV. ANALYSIS RESULT







V. Conclusion

A comparative study is accomplished for both precast construction and ordinary construction. In this investigation different boundaries were viewed as like story displacement, story drift and story shear for relative examination between both the kinds of outlined constructions being precast and conventional structure having g+11 story building. The outlined construction of g+11 story by thinking about gravity, lateral, seismic and wind loads has been investigated and demonstrated in Etabs programming. For this reason, different writings are explored and the assessment and planning are accomplished for both

the traditional and precast construction. In this examination, just individuals are planned and joints are not planned as of now. Execution of the two structures was discovered to be fulfilling. It is seen that the precast construction has given the better outcomes when analyzed inside two designs.

VI. REFERENCES

[1]. Gang Yao, Mingpu Wang, Yang Yang and Jun Li, [Development and Analysis of Prefabricated Concrete Buildings in Chengdu, China], International Journal of Sustainable Development and Planning Vol. 15, No. 3, May, 2020, pp. 403-411.

[2]. Priya Singla and Ravikant Kumar, [Analysis of Precast Building by Response Spectrum Method Using ETABS], International Journal of Innovative Research in Science, Engineering and Technology, Vol. 8, Issue 10, October 2019.

[3]. Aman Agrawal, S.S. Sanghai and Kuldeep Dabhekar, [COMPARATIVE STUDIES BETWEEN PRECAST AND CONVENTIONAL CAST-IN-SITU STRUCTURAL SYSTEMS], International Conference on Advances in Civil Engineering (ICACE 2021).

[4]. Umamaheswara Rao Tallapalem, Shaik Nurulla and Srinivasa Rao Vallu, [Time History Analysis on Precast Building Connections], International Journal of Recent Technology and Engineering (IJRTE) ISSN: 2277-3878 (Online), Volume-8 Issue-4, November 2019.

[5]. Fezayil Sunca, Mehmet Akkose and Alperen Turkay, [Evaluation of Seismic Performance of Prefabricated Structures Using Pushover Analysis], Digital Proceeding of ICOCEE – CAPPADOCIA2015.

[6]. Aswathi V.K and Dona Chacko, [Effectiveness Of Shear Wall On Prefabricated Structures Using ETABS], International Journal of Applied Engineering Research ISSN 0973-4562 Volume 14, Number 12, 2019

Cite this article as :

Nitin Kukreja, Mr. Pradeep Kumar Nirmal, "Analysis of a Prefabricated Structure Considering Lateral Load Using ETABS ", International Journal of Scientific Research in Civil Engineering (IJSRCE), ISSN : 2456-6667, Volume 7, Issue 5, pp.14-19, September-October.2023

URL : https://ijsrce.com/IJSRCE23754