"COMPARATIVE STUDY ON SEISMIC ANALYSIS AND DESIGN OF RCC AND PRECAST CONCRETE CONSTRUCTION OF G+10 HIGH RISE BUILDING"

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Abstract -*Structural Analysis is a branch of engineering that focuses on determining the behavior of structures in order to predict the responses of real-world structures such as houses, bridges, and trusses. During the production of planned loading and the external environment during the structure's operation lifetime. The study's findings would be used to confirm the structure's suitability for usage. For a high-end structural device, computer software is often used to calculate stresses, bending moments, tension, strain, and deformation or deflection. The main goal of this project is to conduct a comparison study using STAAD-PRO software on seismic analysis of RCC and precast construction of high-rise residential buildings (G+10). By comparing the time frame, structure dynamics as per modes, Base shear and storey drift with this programme, comparative results between both constructions can be found. The main goal of this paper is to present the changes that occur in both the structure and the results in a high seismic zone.*

Keywords*:-RCC, Precast, Response spectrum method, Analysis , STAAD-PRO Software*

1.INTRODUCTION

Today, tall structures have proven to be a marvel of engineering. Past earthquakes have shown that a large number of structures are harmed in some way as a result of earthquakes, and it is now necessary to determine seismic reactions over those structures. Due to this the main principle target is to analyzed such structure in such a way that it could withstand in the high seismic zone, but at the same time we have to make earthquake resistant structure instead of earthquake proof because of that strong column weak beam concept is to applied. Response Spectrum analysis is a helpful procedure for seismic examination of structure when the structure indicates linear response. At the same time, the construction of a high-rise building is a critical task that must be carried out with caution. And since RCC construction is very risky to introduce, it's critical to mix up the production technology. Precast concrete is a relatively new construction process that has gained popularity due to its benefits. Since the load weight of precast concrete construction is minimal, the load carrying capacity of the structure increases. The new method of construction is the best for rapid construction but whether it is best in all aspects that we have to concluded. That's why, now its important to finalize the actual behavior of both the structures after the analysis is done.

1 METHODOLOGY

1.1 STRUCTURAL DESIGN CONSIDERATION:

The properties of the building and plan are identical for both the structure and the model. A Typical floor plan of G+10 storey building is used for real RCC and Precast building construction. The material and element properties considered for modeling in Staad-pro software are the same in both structures; the only difference is that RCC acts as a rigid since rotation is limited, while Precast does not act as one mass and thus acts as semi-rigid. The following are the data that were used to analyze both structures:

Beam Size = 230*400

Column Size = 300*800

Height of footing to plinth = 2.5m

Height of each typical floor = 3m

Concrete Strength= 30N/mm^2

Steel strength (Reinforcement)=500N/mm2

Seismic Zone=III

1.2 ANALYSIS AND DESIGN :

In this work we have analyze the structure of RCC and Precast of G+10 high rise buildings with the help of software, studied about the joints connection and the actual behavior of precast and RCC structure during earthquake has been observed related with base shear, time period, storey drift, etc. Also few advantages & Drawbacks are identified by us. Comparative results are find out using Staad-Pro software.

1.3 LOAD CALCULATION:

1] DEAD LOAD:-

a) BRICK LOAD=DENSITY*WALL THK*HT OF FLOOR

= 22*0.23*(3-0.4)

= 13.16 kN/m.

b) SLAB LOAD FOR ONE WAY AND TWO WAY:

FOR BOTH ONE WAY AND TWO SLAB MINIMUM FLOOR THK =120mm.

i.e FLOOR LOAD= FLOOR THK*DENSITY OF CONCRETE+ FLOOR FINISH

= 0.120*25+1= 4 kN/m2

c) PARAPET LOAD= DENSITY OF BRICK*WALL THK*HT OF PARAPET WALL

= 22*0.23*1

=5.06 kN/m

d) STAIRCASE LOAD = 3 kN/m

e) LIFT LOAD =10 kN/m

2] LIVE LOAD:- AS PER IS 875 (PART 2) 1987 TABLE NO:- 1 IMPOSED FLOOR LOADS FOR RESIDENTIAL BUILDING :-

A) FOR ALL ROOMS =2 KN/M2 B) FOR BALCONIES =3KN/M2

1.4 BASIC ASPECTS OF SEISMIC DESIGN:

In addition to building design, the density of the building being built controls seismic design. Since earthquakes cause inertia forces proportional to the mass of the building, stiffness is essential. It's possible that designing a building to behave elastically during earthquakes without causing harm would make the project financially unviable. As a result, the structure could be required to sustain damage in order to dissipate the energy input during the earthquake. As a result, the standard earthquake-resistant architecture theory dictates that ordinary buildings should be able to withstand an earthquake. Wind and earthquakes also have a dynamic effect on structures. In earthquake architecture, however, the building is exposed to random ground motion at its foundation, which induces inertia forces in the structure, which causes stresses; this is displacement form loading. The ground, on the other hand, moves in a cyclic pattern around the structure's neutral location during an earthquake. As a result, the stresses in the building caused by seismic events experience several complete reversals over the short time of the earthquake.

4.5 SPECIFICATION TAKEN FOR SEISMIC LOAD:

- SPECIFICATIONS TAKEN FOR SEISMIC ANALYSIS:-

  AS PER IS 1893 (PART 1): 2016

- FOR ZONE 3 :-SEISMIC ZONE FACTOR Z=0.16
- DEPTH OF FOUNDATION=2.5M
- DAMPING RATIO :- 5% (0.05)
- RESPONSE REDUCTION FACTOR R= 5 FOR SMRF (clause 7.2.6)
- IMPORTANCE FACTOR = 1 (FOR RESIDENTIAL BUIDINGS) (clause 7.2.3)
- SPECTRAL ACCELARATION Av= (2/3*Z/2)*2.5/(R/I) – as per clause 6.4.6

  = (2/3*0.16/2)*2.5/(5/1)

  = 0.027

- ALLOWABLE DRIFT= 0.004 (as per clause 7.11.1.1)
- AS PER IS CODE IMPOSED LOAD ON THE ROOF NEED NOT TO BE CONSIDERED. SO FOR THIS AS PER CLAUSE 7.3.2, PERCENTAGE OF IMPOSED LOAD TO BE CONSIDERED IN THE CALCULATIONS OF SEISMIC WEIGHT =25%

3. CONCLUSIONS

1. As compared to RCC, Precast Structure is not fully constructed by precast components, as IS 1893 also not give the assurance for precast connection to construct in high seismic zone. In short, Indian code is not yet available for precast structure design.
2. Steel required is more in case of precast construction as compared to RCC, as extra steel is required for precast component for lifting purposes at the time of erection process.
3. As the mould used in precast construction is not as per required length or span, that's why for columns, staircase, slabs all precast components required double for each particular complete span on each floor.
4. As compared to RCC, Precast connection is critical, as each precast components is casted separately in a particular mould and also 130mm is casted on

site in case of precast columns and beams and 55mm in case of precast slab that's why it is quite difficult for connection of joints as compared to RCC.

5. Comparatively 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.

6. The Flexibility of the Precast Building is increased by considering the Joints as semi-rigid.

7. It is observed that during earthquake, the severe damage is at beam-column joints in case of RCC. Therefore design and detailing of beam-column joint is more essential than other joints.

8. While in case of Precast structure the severe damage is caused at secondary-primary beam joint. Therefore, it is essential to take care at the time of designing beam joints as compared to other joint.

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