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Analysis of Precast Building System using ETABS Software

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Abstract: Precast concrete is a well-known technology in which some standardized units produced in factories are used for rapid construction. Although the technology was developed many years ago, but the implementation is not a sign in our country. In precast concrete is well known technology in which some standardized units produced in factories are used for rapid construction. Although the technology was developed many years ago, but the implementation is not a sign in our country. In this study, we conducted a detailed study of the various concepts of prefabricated, pass a number of references * found the facts associated with it. The existing reinforced concrete foundation structures are wide, and also include buildings with prefabricated elements that are largely used since the fifties in the first place to meet the needs of production and tertiary goals.
Keywords: Precast, RCC, ETABS, storey shear, drift & time period

I. INTRODUCTION

Depending on the types of members used, prefabricated systems can be classified in bearing wall systems, the time of the Resistance framework system and the dual system. In the wall system, the structure is mainly composed of structural walls that carry the vertical and horizontal forces to the foundation. The transfer of power of flexing capacity requires vertical reinforcement through the height of the wall and can be provided with clutch strips or vertical post-connections are the most important part of prefabricated structures. Task in the design of prefabricated systems is to search the economic and practical method for connecting members with adequate strength and plasticity to load the earthquake. Behavior of the structure depends mainly on the behavior of connections.

This classification is based on character of connections between members. In equivalent monolithic systems, links between members are designed to imitate the behavior of concrete construction in place. Protruding longitudinal reinforcement strips from members are growing, welded or mechanically connected, and then concrete cast in the common region. It is also called wet connection. As in any other system, seismic considerations are crucial in prefabricated buildings. Precast reinforced concrete can be successfully used in designs designed for earthquake resistance, provided careful attention is given to conceptual and detailed design, and for fabrication and erection. Seismic structure indicators are mainly related to its lateral strength, rigidity, plasticity and unity of components.

The aim of the present work is to analyze precast building and to carry out the parametric analysis on different parameters.

II. REVIEW OF LITERATURE:

ETABS work is used to analyze the displacement of the structure of G + 11, taking into account gravity and lateral loads. The next conclusion is drawn from the work. 1. The variation of the axial force with the stories is linear. The drop of the maximum axial force between the storey 11 and 12 is 7.26%. 2. Changing the out-of-plane moment with stories is linear. The difference in the maximum out-of-plane moment floors is 11 and 12 is 9.04%. 3. Variations of lateral loads with stories are nonlinear. The difference in maximum lateral loads between storey 11 and 12 is 0.54%. 4. Variations of shear force with stories are nonlinear. The difference in maximum shear force between storey 11 and 12 is 19.98%. 5. Change of storey drift with a storey is nonlinear. The maximum two-storey drift in the storey 12 is 0.199 mm. 6. The variation of storey shear with a superficial displacement is not linear. The maximum two-storey slope in one-storey-608.25 Kn. 7. (Pernaty Ramu et al 2014).

Having considered the results that were concluded, that deflection and storey drift occurred in the prefabricated structure more in comparison with the structure of APC. Base offset values also differ in comparison to the RVZ structure. The use of pre-fabrication and pre-assembly is estimated almost twice in the last 15 years, increasing by 86%. The use of prefabricated concrete structures can significantly reduce the amount of construction waste created on construction sites. Negative impacts on the environment on the sites. Increased quality control of concreting work. Reduce the number of jobs. Employee safety enhancement. Other barriers to manufacturing and assembly of increased difficulties with transportation, greater rigidity and more advanced requirements for procurement(T.Subramani et al 2018).

Of the whole study it can be concluded that the precast concrete system is economical than the usual cast in the place of the method, but still there are some conditions that we have to take care of when using prefab, it is the amount of construction, the distance from the production area. Type of building, etc. We have determined that for the standard * recurring work of the prefabricated is the best option for selection. In observing the most important thing to watch a project located in the construction engineering is the time effective it requires less time for construction. It requires a skilled worker and qualified contractor, lower initial cost especially for a large project. We can achieve better specific quality control and light concrete to unite. The main limiting of teams is transportation from the place of production to the location where it should be fixed. (Akash Lanke et al 2016).

III. MODELING

Building Description (RCC- G+3)

Table 1: Building Description for the Building

Plane dimensions	42x42 m (Office Building)
Total height of building	15.6 m
Height of each storey	3.6m
Height of parapet	1m
Depth of foundation	1.2m
Size of Primary beams	300X600 MM
Size of Secondary beams	230X600 MM
size of columns	600X600 MM
Thickness of slab	150 mm
Thickness of external walls	230 mm
Thickness of internal walls	No Internal Walls
Seismic zone	III
Soil condition	Medium
Response reduction factor	5
Importance factor	1.2
Floor finishes	1.5 kN/m2
Live load at all floors	4 kN/m2
Grade of Concrete	M 35
Grade of Steel	Fe500
Density of Concrete	25 kN/m3
Density of brick masonry	20 kN/m3

The models considered in the this work consists of 3 models i.e Model I - RCC building, Model II- Precast Building with simply supported Connection (PRECAST-I) & Model III- Precast Building with Partial Moment resisting Connection (PRECAST-II). The 3 models are considered each for G+3, G+6 & G+9 building.

IV. RESULTS

1) *G+3 Building:* The three models for RCC & precast construction is modeled in ETABS, the results for the same are presented in the following graphs.

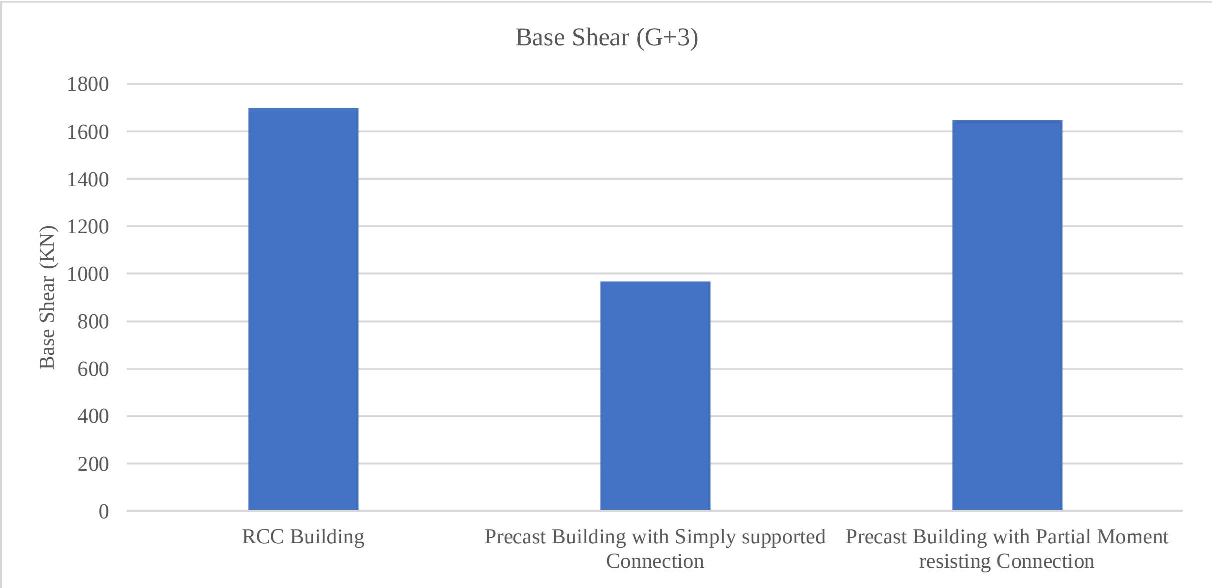

Fig. 1: Base Shear for G+3 building

Fig. 2: Storey Displacement for G+3 building

The base shear storey displacement are presented in the above graph and it is clear that the model-II gives the maximum results as compared to other models.

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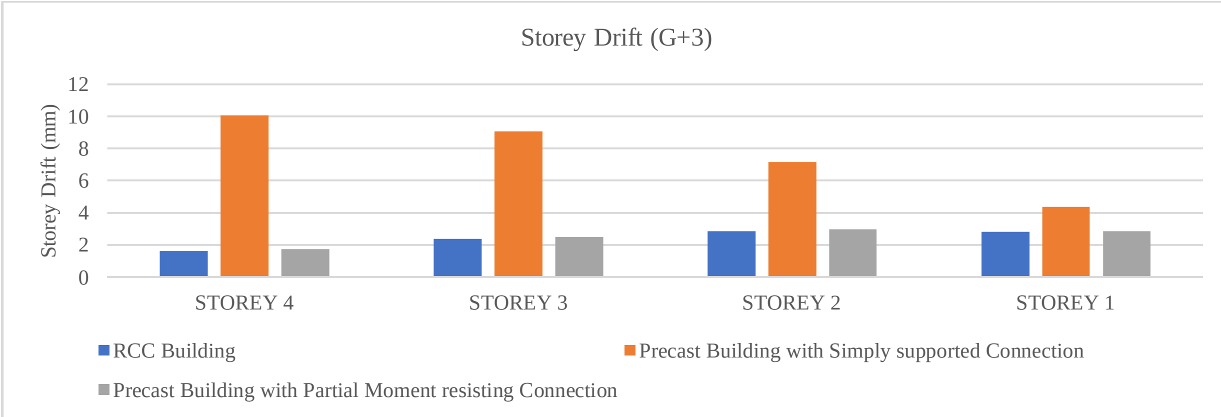

Fig. 3: Storey Drift for G+3 building

Storey drift is found to be maximum in precast model-I with simply supported connection at the ends and the precast model with partial moment resisting connection gives minimum

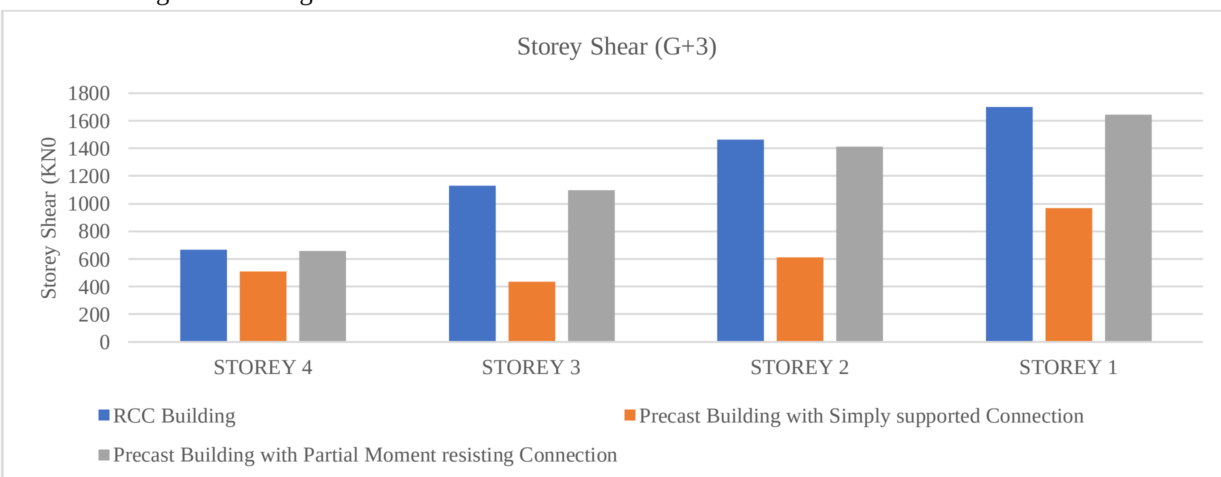

Fig. 4: Storey Shear for G+3 building

Storey shear is maximum for storey 1 as compared to other storey, the storey shear is minimum in case of storey 4 with precast model-I

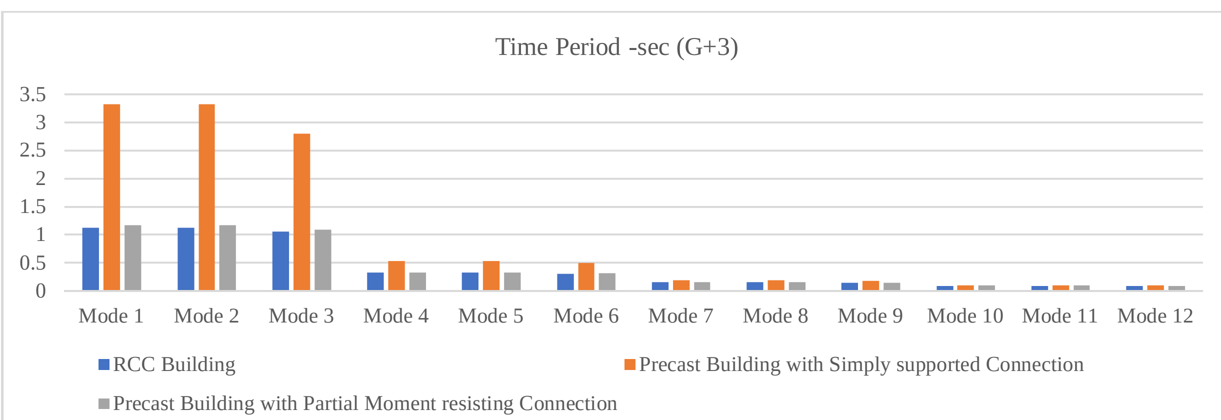

Fig. 5: Time Period (sec) for G+3 building

Time period found to be minimum for model-12 for all the models of RCC & precast while it maximum for the precast model-I for mode 1.

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2) G+6 Building: The 3 models are presented for G+6 building as follows

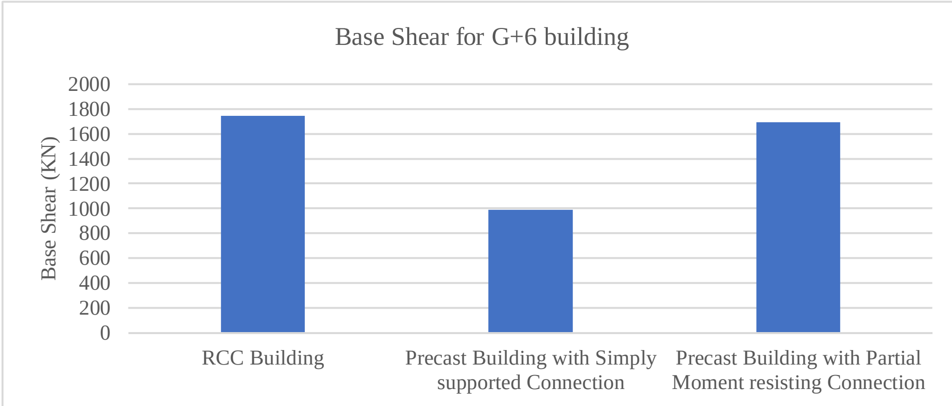

Fig. 6: Base Shear for G+6 building

Base shear found to be maximum in case of RCC building as compared to other models of precast construction.

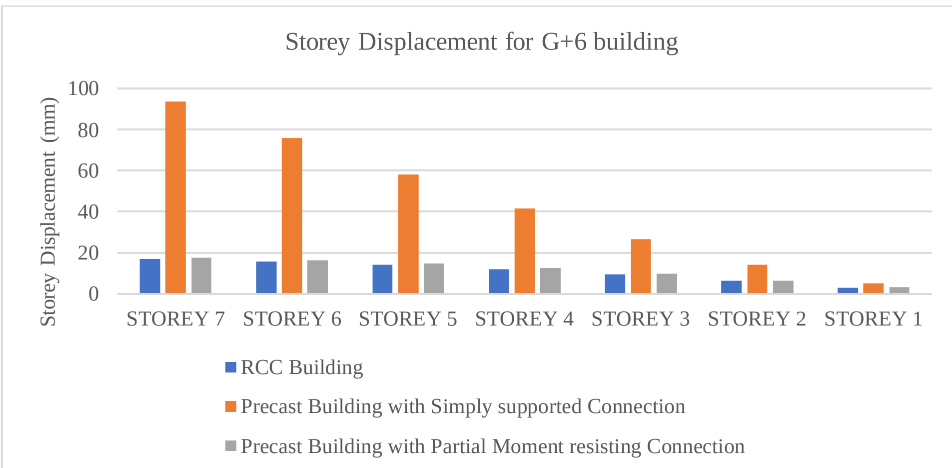

Fig. 7: Storey Displacement for G+6 building

Storey displacement for storey 7 found to be maximum as compared to other stories while it is maximum in case of precast model-I.

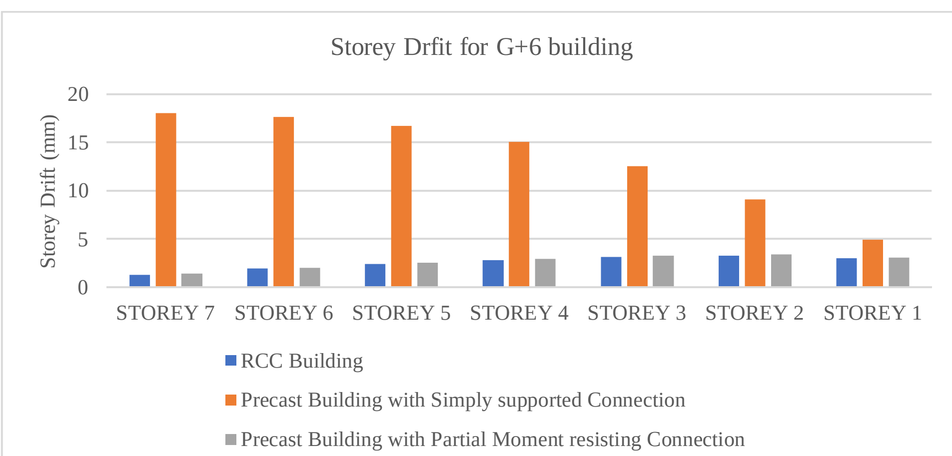

Fig. 8: Storey Drift for G+6 building

Storey drift is maximum for the case of precast construction as compared to other models and it is minimum for storey 1.

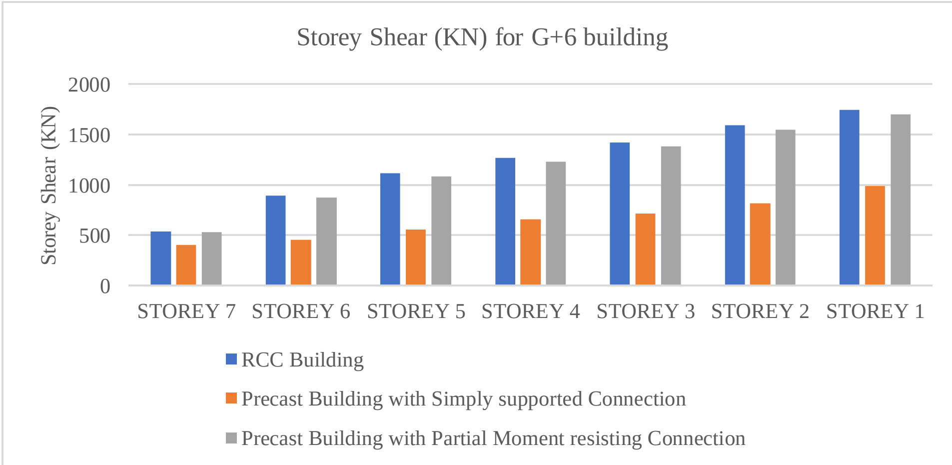

Fig. 9: Storey Shear for G+6 building

Storey shear is maximum for the storey 1 for all three models while it is minimum for storey 1.

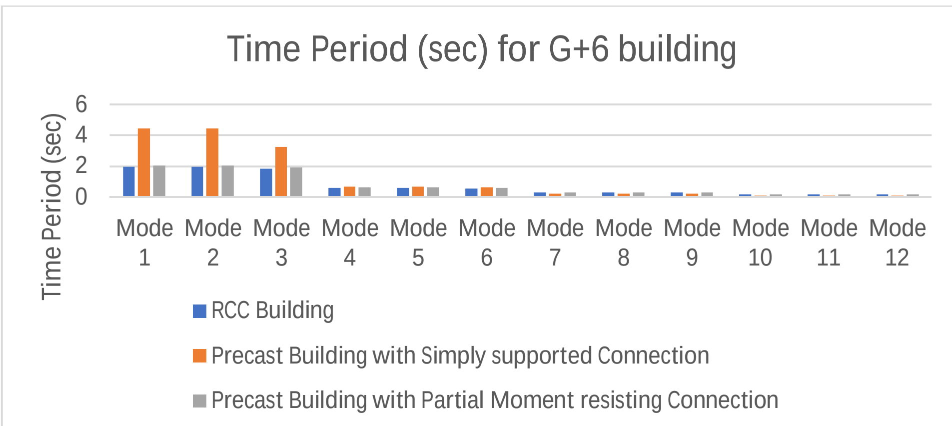

Fig. 10: Time Period (sec) for G+6 building

Time period (sec) is minimum for mode 12 for all three models as compared to other modes

3) G+9 Building: The following models are for the G+9 buildings

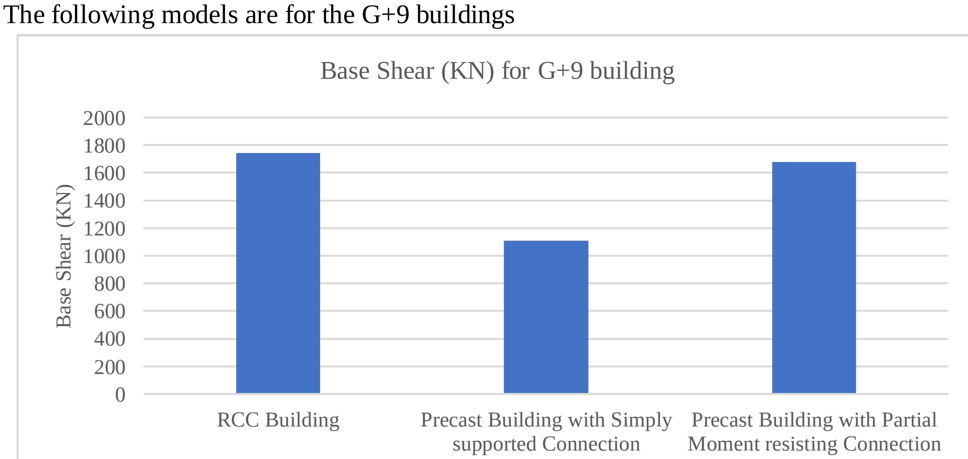

Fig. 11: Base Shear (KN) for G+9 building

Base shear is maximum for RCC building as compared to other models of precast.

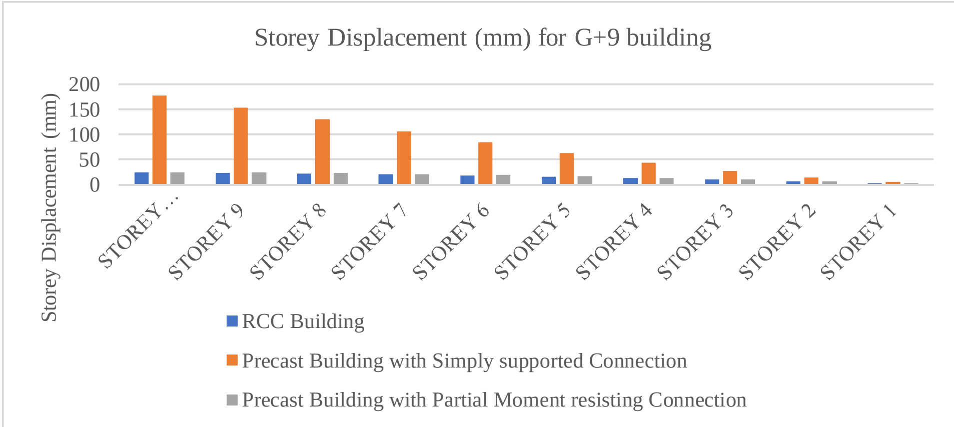

Fig. 12: Storey Displacement for G+9 building

Storey displacement is maximum for storey 10 as compared to other stories. The maximum storey displacement is found to be in precast model-I.

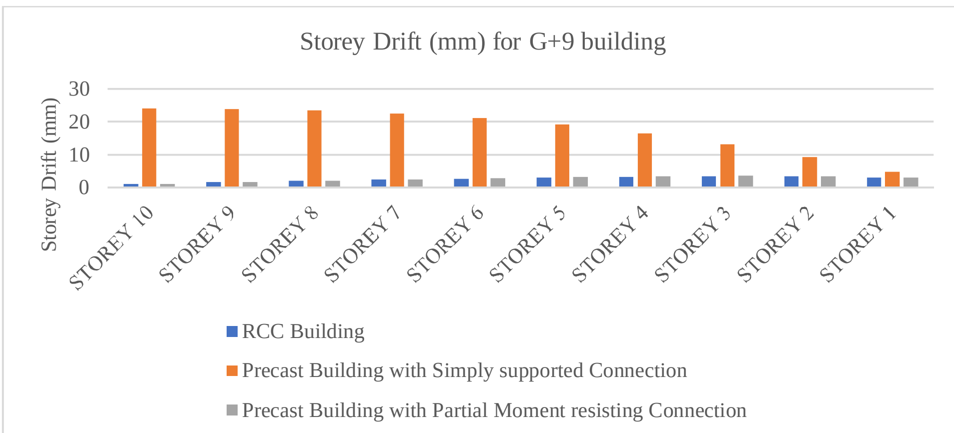

Fig. 13: Storey Drift for G+9 building

Storey drift is found to be maximum in storey 10 and the minimum in storey 1, the precast model-I gives the maximum drift as compared to other models.

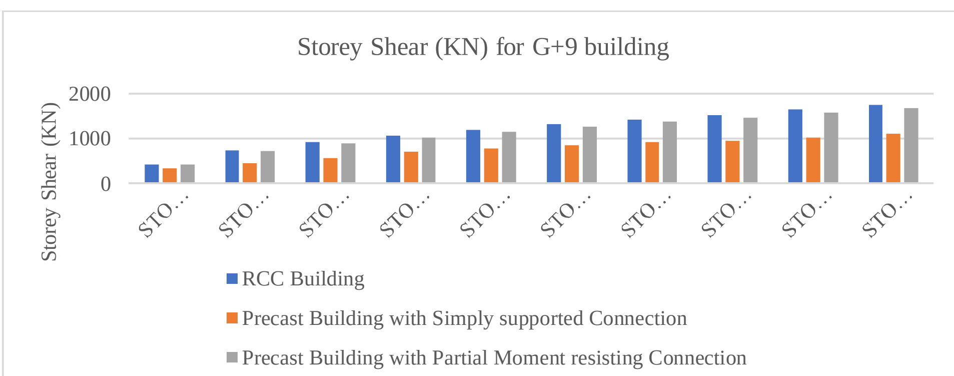

Fig. 14: Storey Shear for G+9 building

Storey shear is found to be maximum in storey 1 as compared to other stories while it is maximum in RCC building as compared to other precast models.

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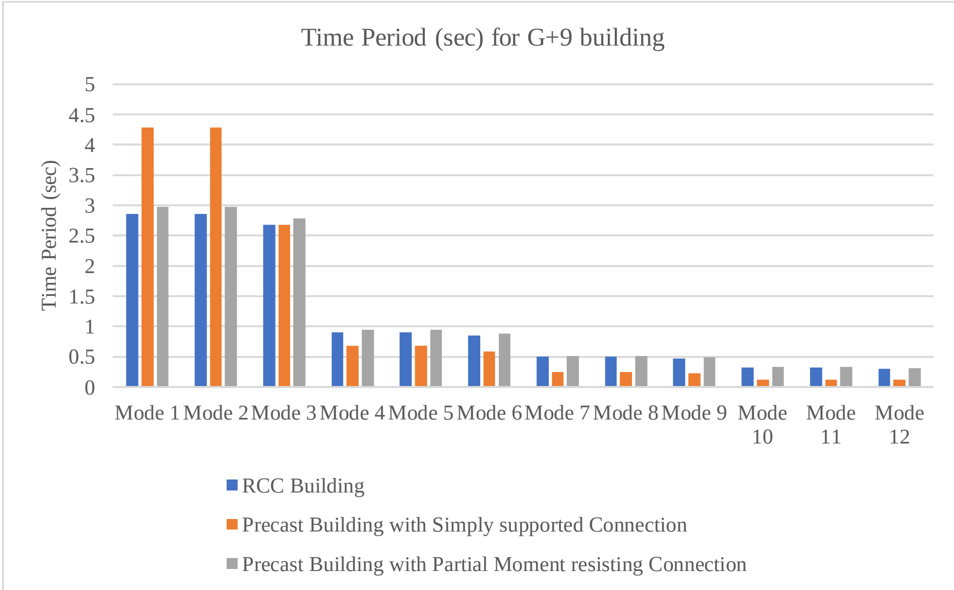

Fig. 15: Time Period (sec) for G+9 building

Time period is maximum for mode 1 and minimum in mode 12 while the precast model-I gives maximum time period (sec) as compared to other models.

V. CONCLUSION

From the above study the following conclusion can be drawn:

A. The base shear storey displacement are presented in the above graph and it is clear that the model-II gives the maximum results as compared to other models.
B. Storey drift is found to be maximum in precast model-I with simply supported connection at the ends and the precast model with partial moment resisting connection gives minimum.
C. Storey shear is maximum for storey 1 as compared to other storey, the storey shear is minimum in case of storey 4 with precast model-I.
D. Time period found to be minimum for model-12 for all the models of RCC & precast while it maximum for the precast model-I for mode 1.
E. Time period is maximum in case of G+6 building in precast model-I

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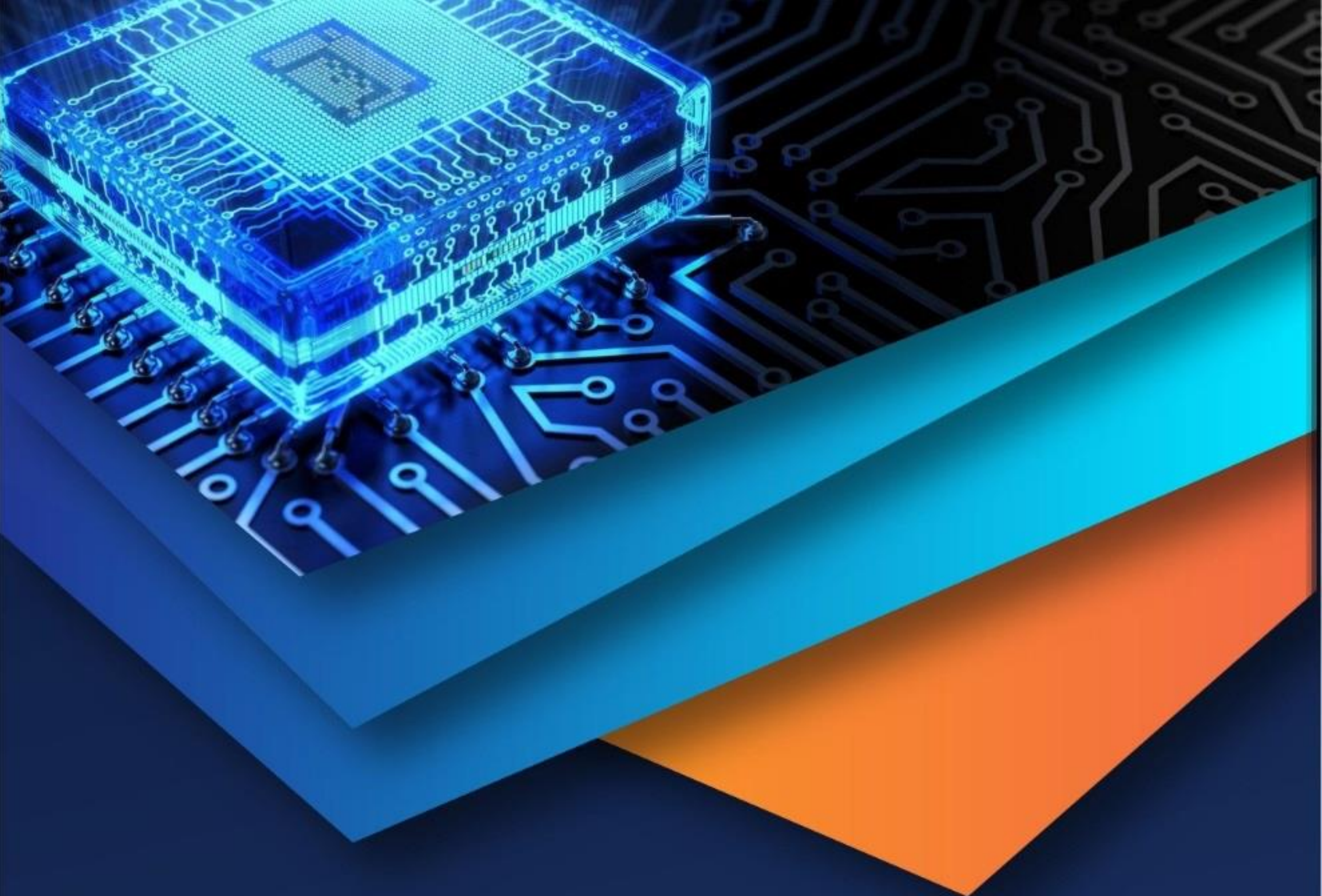

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