

Seismic Analysis of L-Shaped Highrise RCC Framed Building Second Order Analysis

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Abstract - In present work, Forty storey buildings (120m) have been modeled using software STAAD Pro V8i by P-delta analysis. All the analyses has been carried out as per the Indian Standard code books. Based on the literature of previous studies most effective positioning of shear walls has been chosen. In this paper P-delta analysis of building structures is performed, The methods reviewed include the amplification factor method, the direct method, the iterative method, the negative property member method and second order computer program method. The influence of asymmetry of building on the P-delta effect in elastic ranges of behaviour is evaluated. The result indicated that the effect of P-delta is quite sensitive to characteristics of ground motion such as the frequency content of earthquake. Under P-Delta effect, displacement varies exponentially with increase in height or increment in stories. Axial force also varies with the height of the structure. Because of wide variation in displacement with increase in slenderness, P-Delta analysis is required for structures taller than 7 storeys. the P- Delta effect will be substantial when lateral forces exist on the structure and this increases with increase in number of storey. The P-Delta effect is not predominant on buildings up to seven storeys and it is very negligible when only gravity loading exists on the structure.

Index Terms - P-Delta Analysis, Elastic Ranges, L shaped building, Axial force, Gravity Loading, Lateral Forces

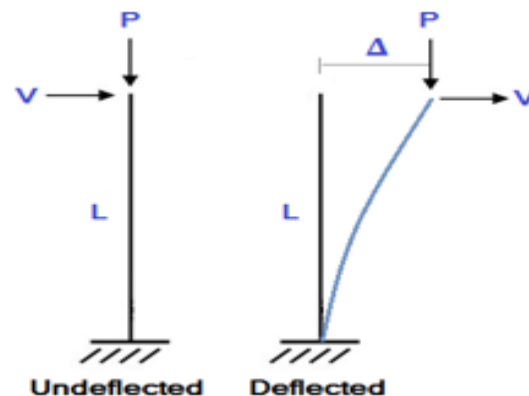
INTRODUCTION

P-Delta Analysis

The term "P- Δ analysis" itself explains the meaning, when a structural member is loaded, then its shape changes and due to this additional forces & moments are induced. It is second order analysis. P-Delta Analysis is a type of analysis that is particularly important for laterally displacing multi-story building structures experiencing a gravity load.

P- Delta Effects

When subjected to lateral displacements, the building structure will deform which in turn produces second order over turning moments and usually these are not taken into consideration in the case of dynamic and static analysis.



P-Big Delta Effect (P- Δ)

P- Δ is referred to effects of gravity loads applied on structures which are laterally displaced. For reference, seismic or wind loads create horizontal displacements (Δ) and vertical loads (P) also known as gravity loads also act vertically on displaced structure at the same time cannot be totally eliminated. It developed countries have carried out.

P-Small Delta Effect (P- δ)

P- δ is referred to the axial load effects in a member subjected to deflection between the end points. For instance, loads on columns due to wind load, earthquake forces and self- weight results in deflection as the result of beams which are supported on it.

LITERATURE REVIEW

For the purpose of understanding the significance of the various design parameters and efficacy of this

study it is necessary to review the literature of past researches.

Galotti R. et al. (1989) In this paper P-delta analysis of building structures is performed. The P-Delta analysis method were reviewed and compared in terms of their efficiency and accuracy. The methods reviewed include the amplification factor method, the direct method, the iterative method, the negative property member method and second order computer program method. The results were identical to those given by the iterative method while the analysis took less than one-third of the time. It was found that P-Delta analysis is more suitable for high rise structures. They concluded that due to non-linear relationship between deflection and the gravity loads, it is necessary that loads corresponding to the failure state under consideration be used in P-Delta analysis.

Azimine ad A. et al. (2004) They examined the interaction of torsion and P-Delta effects in tall buildings. The influence of asymmetry of building on the P-Delta effect in elastic ranges of behaviour is evaluated. Elastic static, elastic dynamic, inelastic static and inelastic dynamic behaviour of four different buildings with 7, 14, 20 and 30 storeys with and without P-Delta effect were investigated. Each building with 0%, 10%, 20% and 30% eccentricity levels were considered. It was found that the P-Delta-effect increases with increase in number of storeys and eccentricities of the buildings. The result indicated that the effect of P- Delta is quite sensitive to characteristics of ground motion such as the frequency content of earthquake. Conclusion is that the characteristics of lateral load resisting system have far more importance compared with the number of storeys in the building.

UddinA.etal. (2013)In this paper study of P-Delta effect in reinforced concrete structures of rigid joint. 12 cases and 2 different analyses were performed to throw light into P-Delta effect in RC framed structures of rigid joints. He observed that, under P-Delta effect, displacement varies exponentially with increase in height or increment in stories. Axial force also varies with the height of the structure. It was concluded that both linear static and P-Delta analyses are necessary for tall RC structures.

OBJECTIVES

The objectives of this study are:

- To analyse the seismic performance of L-shaped buildings with and without P-Delta analysis.
- To compare the results obtained from linear analysis and P-Delta analysis.

The different parameters such as forces, storey displacement, time period, frequency, torsion moment responses, storey drift in different seismic zones in different models are compared to achieve above objectives.

PROPOSED METHODOLOGY

- Prepare the plan of L-shaped Building.
- Design of buildings using E-Tabs 2015
- Linear analysis of 10, 20, 30, 40 & 50 storey of L-Shaped building for various parameters using E-Tabs 2015.
- P-Delta analysis of 10, 20, 30, 40 & 50 L-Shaped building for various parameters using E-Tabs 2015.
- Compare the result of linear analysis & P-Delta analysis.

EXPECTED OUTCOMES

- 1 It is concluded that due to non-linear relationship between deflection and the gravity loads, it is necessary that loads corresponding to the failure state under consideration be used in P-Delta analysis.
- 2 The characteristics of lateral load resisting system have far more importance compared with the number of storeys in the building.
- 3 Both linear static and P-Delta analyses are necessary for tall RC structures.
- 4 The building response values on P-Delta analysis were twice as that on static analysis. The X bracing in continuous bracing pattern is proven to be more effective under both static and P-Delta analyses.
- 5 Because of wide variation in displacement with increase in slenderness, P-Delta analysis is required for structures taller than 7 storeys.
- 6 The P-Delta effect will be substantial when lateral forces exist on the structure and this increases with increase in number of storey. The P-Delta effect is not predominant on buildings up to seven storeys and it is very negligible when only gravity loading exists on the structure.

- 7 The effect of P-Delta increases as the height of the building increases, and it can be reduced up to certain extent by the construction of shear walls.
- 8 The structures with irregularity configurations are 40% more prone to destabilizing stresses i.e., 1.4 times more when compared to conventional rectangular non-irregularity structure and dynamic stresses are 1.7 times more than the linear static method of wind analysis.
- 9 The impacts of P-Delta is quite sensitive to ground movement, for example, the frequency content of quake. The affectability is still vital however not exactly the dynamic cases. All in all, the affectability to ground motion increases, as the eccentricity increases. The impact of "P- Delta" analyses is discovered higher in static and dynamic analyses and the impact of "P- Delta" analyses is much higher when the plan of building is asymmetric with respect to symmetric building.

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