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# COMPARATIVE STUDY OF PRECAST AND CAST-IN-SITU BUILDING

Dhrumal C.Kanpariya[1], Nihil Sorathia[2]

[1]*P.G. student, Department of Structural Engineering, Parul University, Vadodara, Gujarat, India*
[2]*Associate Professor, Department of Civil Engineering, Parul University, Vadodara, Gujarat, India*

**Abstract** — *The analysis of a Precast and cast-in-situ building. It's structural system to determine the deformations and forces induced by applied lateral loads. The precast building system includes precast hollow core slab, precast beam and columns. The cast-in-situ building system includes precast slab, beam and columns. Different configuration of precast and cast-in-situ slab, beam and columns are studied. A regular building with G+12 story height is considered. In Precast and cast-in-situ building is considering dead load, live load, seismic forces there is a range of methods from a linear analysis to a sophisticated nonlinear analysis depending on the purpose of the analysis in the design process. In this paper a residential G+12 RC frame building is analysed by the linear analysis approaches of Equivalent Static Lateral Force and Seismic coefficient methods using ETABS Ultimate 2016 software as per the IS- 1893-2002-Part-1. These analysis are carried out by considering different seismic zones, medium soil type for all zones and for zone III using SMRF frame type and for those of the rest zones using OMRF frame. Different parameter like base shear and displacements are plotted in order to compare the results of the static analysis*

***Keywords****- Cast-in-situ building, Precast building, Seismic Analysis, Base shear, Maximum story displacement*

## I. INTRODUCTION

Prefabricated and cast-in-situ building systems are widely adopted in public buildings as well as in private building projects. The standardization and mechanization has brought a substantial change in the development of the construction industry worldwide over last few decades. Recently in India use of cast-in-situ and prefabrication in building construction is increasing. With the adoption of more mechanization, computer aided manufacturing, and intelligent management systems, the extensive use of prefabrication contributed to sustainable development by using cleaner and more resources saving production process.

The cast-in-situ building system includes precast slab, beam and columns. Different configuration of precast and cast-in-situ slab, beam and columns are studied. A regular building with G+12 story height is considered. In Precast and cast-in-situ building is considering dead load, live load, seismic forces, combinations as per IS code. When earthquakes occur, a buildings undergoes dynamic motion. This is because the building is subjected to inertia forces that act in opposite direction to the acceleration of earthquake excitations. These inertia forces, called seismic loads, are usually dealt with by assuming forces external to the building. So apart from gravity loads, the structure will experience dominant lateral forces of considerable magnitude during earthquake shaking. It is essential to estimate and specify these lateral forces on the structure in order to design the structure to resist an earthquake. The ductility of a structure is the most important factors.

## II. PARAMETRIC STUDY

Analysis of the Pre-cast and cast-in-situ frame and load Combinations is carried out by applying IS-456:2000. Considering preliminary sizing of all precast and cast-in-situ members and given specific properties. Design of Precast and cast-in-situ Structural members has been carried out by Code for flexure, shear, Torsion and Axial Loads based on respective clauses, concrete is designed on the basis of Ultimate loading. This is often referred to as Strength design. These factored loads are used to determine maximum factored moments, shears and other effects which are then compared to the strength of the member. Gravity load and Lateral Load Analysis Below table shows the Dimensional data of both building

**Building Data**
Column size (Base to 3$^{rd}$) = 300 mm × 675 mm
Column size (4$^{th}$ to 6$^{th}$)= 230 mm × 675 mm
Column size (7$^{th}$ to 9$^{th}$)= 230 mm × 600 mm
Column size (10$^{th}$ to 12$^{th}$) = 230 mm × 525 mm
Beam size = 230 mm × 450 mm
Thickness of slab = 115 mm
Stair case slab thickness = 150
Parapet wall 1 m Height = 230 mm
Live load = 2 kN/m$^2$

Floor Finish = 1 kN/m$^2$
Grade of Concrete = M25 MPa
Yield strength of steel = 415 MPa
Density of concrete = 25 kN/m$^3$
Density of Brick wall =20 kN/m$^3$
5% Damping

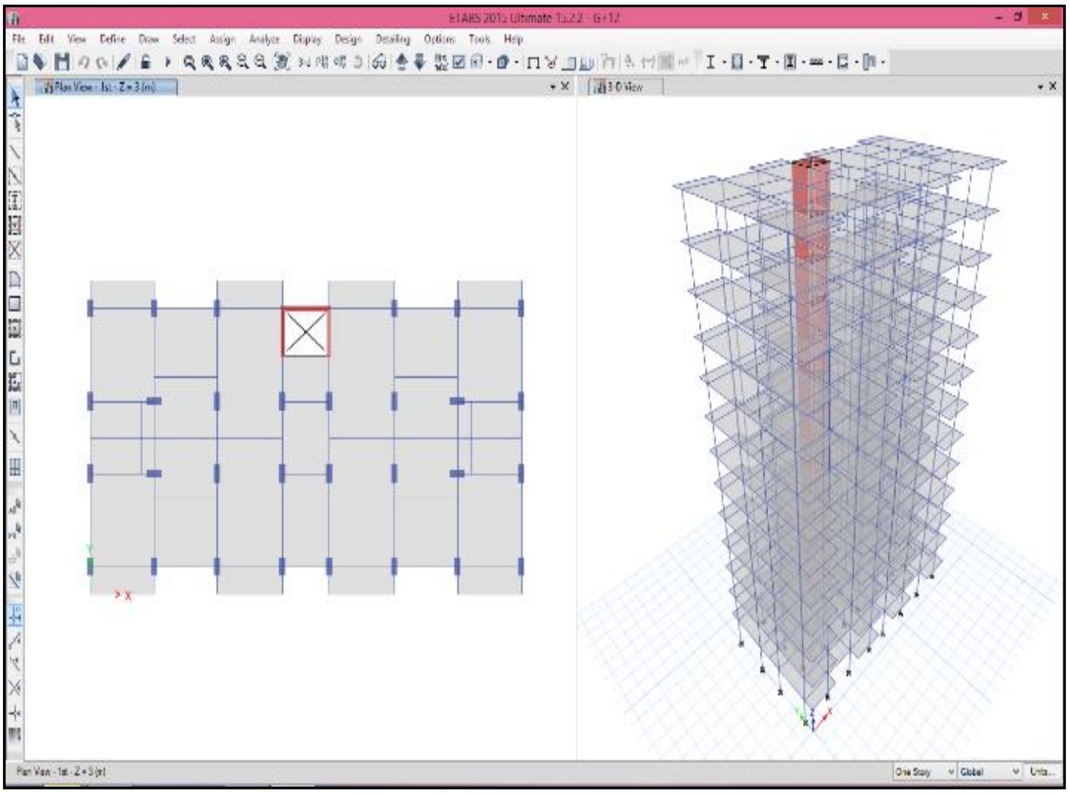

Figure 1 Plan & 3D view of Building

## III. RESULT

Base shear for multi-story buildings obtained by Seismic Co-efficient Method and it is seen that the maximum base shear in X and Y direction is observed at Surat site for G+12 story building.

Table 1 Comparison of base shear (all value are in kN)

| Floor level | Cast-in-situ Building | | Pre-cat Building | |
|---|---|---|---|---|
| | X-Direction | Y-Direction | X-Direction | Y-Direction |
| Terrace | 81.77 | 96.05 | 86.31 | 14.42 |
| Story 12 | 176.80 | 207.70 | 186.62 | 225.79 |
| Story 11 | 257.27 | 302.23 | 271.55 | 328.56 |
| Story 10 | 323.77 | 380.36 | 341.75 | 413.50 |
| Story 9 | 377.93 | 443.99 | 398.92 | 482.68 |
| Story 8 | 421.05 | 494.65 | 444.45 | 537.75 |
| Story 7 | 454.07 | 533.44 | 479.29 | 579.92 |
| Story 6 | 478.93 | 562.64 | 505.53 | 611.66 |
| Story 5 | 496.66 | 583.47 | 524.24 | 634.31 |
| Story 4 | 508.01 | 596.80 | 536.23 | 648.81 |
| Story 3 | 514.45 | 604.36 | 543.01 | 657.02 |
| Story 2 | 517.33 | 607.75 | 546.06 | 660.71 |
| Story 1 | 518.05 | 608.59 | 546.83 | 661.63 |

 

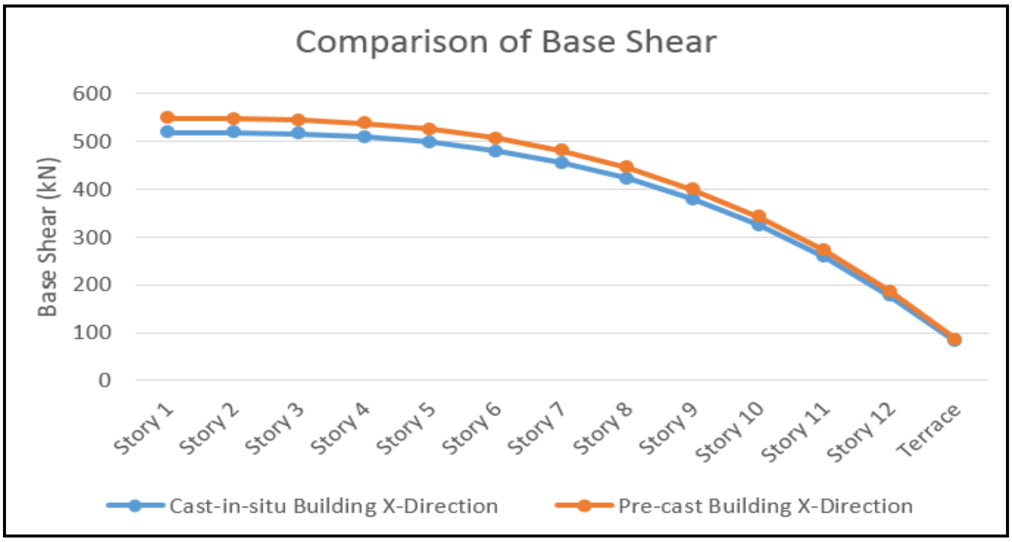

Figure 2 Comparison of Base shear in X-Direction for Both Building

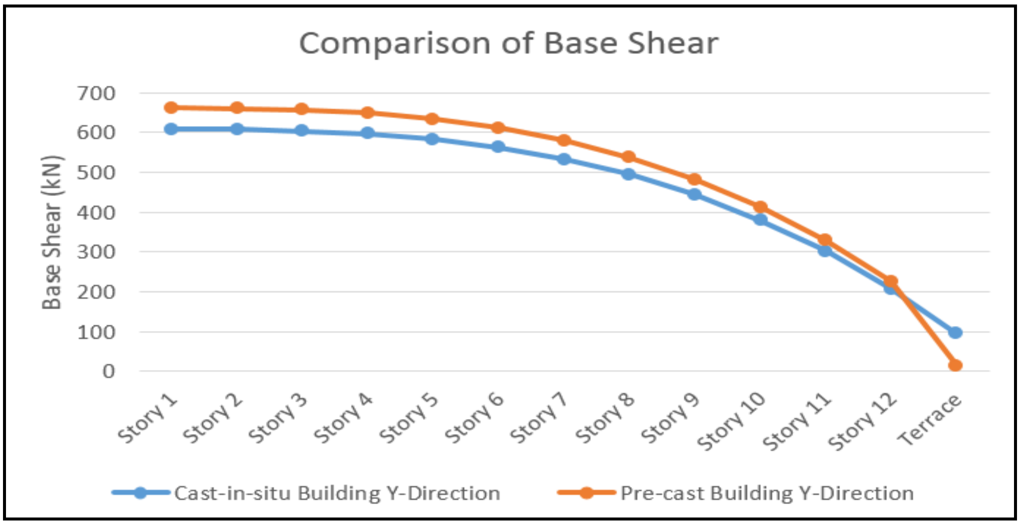

Figure 3 Comparison of Base shear in Y-Direction for Both Building

Table 2 Story Displacement

| Floor level | Cast-in-situ Building | | Pre-cast Building | | % Diff. | |
|---|---|---|---|---|---|---|
| | X-Direction (mm) | Y-Direction (mm) | X-Direction (mm) | Y-Direction (mm) | X | Y |
| Terrace | 50.062 | 6.547 | 46.326 | 6.969 | 7.46 | 6.06 |
| Story 12 | 47.471 | 7.185 | 44.062 | 7.511 | 7.18 | 4.34 |
| Story 11 | 44.264 | 7.446 | 41.195 | 7.688 | 6.93 | 3.15 |
| Story 10 | 40.406 | 7.327 | 37.677 | 7.49 | 6.75 | 2.18 |
| Story 9 | 35.989 | 6.891 | 33.6 | 6.98 | 6.64 | 1.28 |
| Story 8 | 31.273 | 6.302 | 29.231 | 6.33 | 6.53 | 0.44 |
| Story 7 | 26.298 | 5.539 | 24.595 | 5.512 | 6.48 | 0.49 |
| Story 6 | 21.292 | 4.711 | 19.925 | 4.644 | 6.42 | 1.42 |
| Story 5 | 16.827 | 4.129 | 15.819 | 4.061 | 5.99 | 1.65 |
| Story 4 | 12.531 | 3.476 | 11.859 | 3.419 | 5.36 | 1.64 |
| Story 3 | 8.305 | 2.40 | 7.912 | 2.509 | 4.73 | 4.34 |
| Story 2 | 4.532 | 1.543 | 4.363 | 1.525 | 3.73 | 1.17 |
| Story 1 | 1.481 | 0.541 | 1.45 | 0.54 | 2.09 | 0.18 |

 

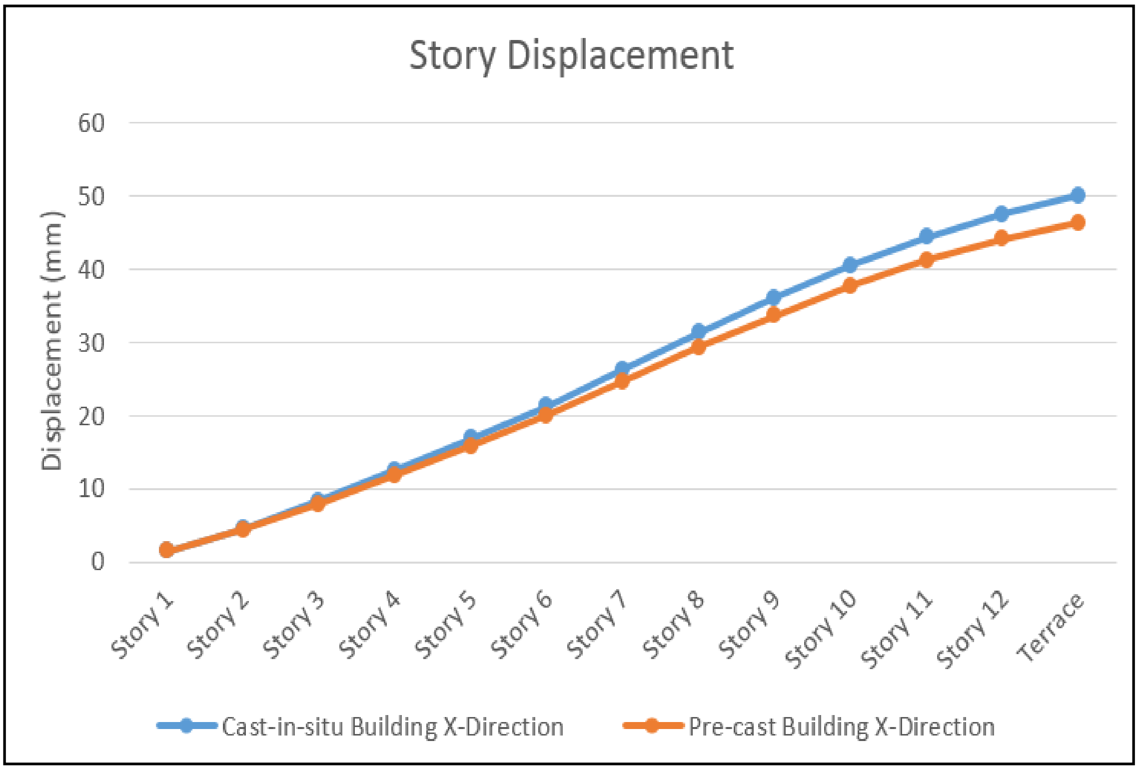


Figure 4 Story Displacement in X-Direction for both Building

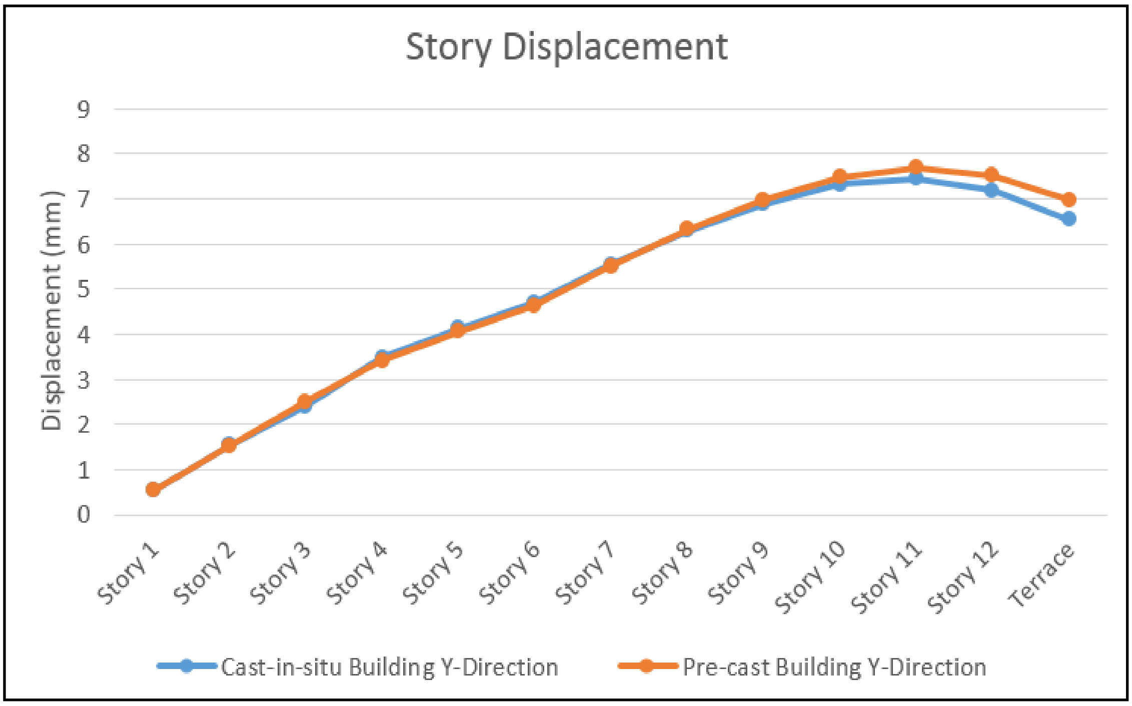


Figure 5 Story Displacement in Y-Direction for both Building

## IV. CONCLUSIONS

I. Base shear is 5.26 % more in X-direction of Precast building compare to the cast-in-situ building
II. Base shear is 6.73 % more in Y-direction of Precast building compare to the cast-in-situ building
III. Story displacement is 7.14 % less in X-direction of Precast building Compare to the X-direction of Cast-in-situ building
IV. Story displacement is 1.75% more in Y-direction of Precast building Compare to the Y-direction of Cast-in-situ building during seismic load in X-direction.

 

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