

QUANTITATIVE ANALYSIS OF PRECAST AND CAST IN-SITU RESIDENTIAL HIGH RISE BUILDING

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Abstract- Construction industry which contributes almost 15% to the world economy comes under one of the most important sectors. Due to the large growth in population, the need for housing increases. To compete with the current growth, the construction of houses is to be completed at a faster rate. To accomplish this, a new type or a modified version of conventional construction to be used. Precast construction which is a modified version of cast-in situ, is used for constructing a large number of houses in short duration. There are both advantages and disadvantages in this type as well. The main advantage is constructing using precast saves almost 50% time but there is an increase in cost as well. So a research is done comparing the cost and time for both conventional and precast structures. Study is done based on the estimation which is done manually and scheduling which is done using Primavera software for both precast and conventional methods.

Keywords- Precast, conventional, estimation, scheduling, comparison

I. INTRODUCTION-

Precast concrete is a construction product produced by casting concrete in a reusable mold or form which is then cured in a controlled environment, transported to the construction site and lifted into place (tilt up). In contrast, standard concrete is poured into site-specific forms and cured on site. Precast stone is distinguished from precast concrete using a fine aggregate in the mixture, so the final product approaches the appearance of naturally occurring rock or stone. More recently expanded

polystyrene is being used as the cores to precast wall panels. This is lightweight and has better thermal insulation.

The main advantage of precast over cast in-situ is that the time for completion of the project. Precast construction saves around 30-40% of time which indirectly saves cost which occurs due to inflation. Also, the percentage of delay caused by external factors can be reduced when construction is done by precast structures.

II. OBJECTIVE-

The main objective of this paper is to find out which construction technique is suitable for high rise buildings. This is done by finding out the cost and time for completion of the project. To find out the appropriate method for building of high rise structures, we “**Compare the cost and time for both precast and cast in-situ building**”.

III. SCOPE-

The scope of this project is to compare the conventional and precast construction and the results are based on the arrival results. Construction should be done effectively and overall cost should be saved. Also the duration of project should be minimized.

IV. LITERATURE REVIEW-

Karthiga Priya et al.,(AUG 2018) conducted a comparative study on precast and conventional construction. In this paper, the comparison is

based on cost and time and a survey is done on precast construction. The results obtained in this paper is as follows- Cost of construction of precast is 1.4% higher than the conventional one, the time for completion of precast construction is 15.17% lesser than the convention one.

Dinesh Kumar et al.,(APRIL 2015) conducted a comparative study based on prefabrication construction and conventional construction. The study is based on cost and time and also a survey is done for precast techniques available in the industry. For this, a residential building is taken and the study is based on quantity estimation, determination of project duration and data collection from the industry. The results obtained in this paper are as follows- The cost for individual double storey house is 13% higher when it is built using precast form, the time for completing the project is reduced by 63 days when it is done by precast elements. Based on survey it is found that prefab construction has more advantage in the industry.

Siva Priya et al.,(MAY 2016) studied about the various methods to replace conventional cast in-situ technique. In that study they found out precast construction is the suitable methods when compared to other methods like 3D printing as the stability remains the same in precast technique. Also, they found out that the overall cost of the project is reduced by 20% when the project is completed by precast technique.

V. METHODOLOGY-

A plan of dimension 1380 sqft is drawn using Auto Cad, the carpet area is 1198 sqft. The dimensions of the house are as follows:-

Living and Dining	30 x 20 sqft
Master Bedroom	13 x 12 sqft

Bedroom 2	12 x 11 sqft
Toilet and Bathroom 1	7 x 10 sqft
Toilet and Bathroom 2	7 x 10 sqft
Kitchen	12 x 10 sqft
Balcony	10 x 5 sqft

Also, a 3D view of both precast and conventional building are drawn to show the difference between precast and conventional construction and to show the G+7 view of the building which consists of 48 houses (8houses per floor).

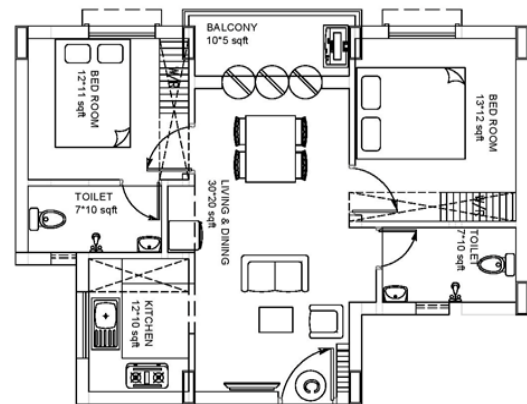


Figure.1 Plan of the house

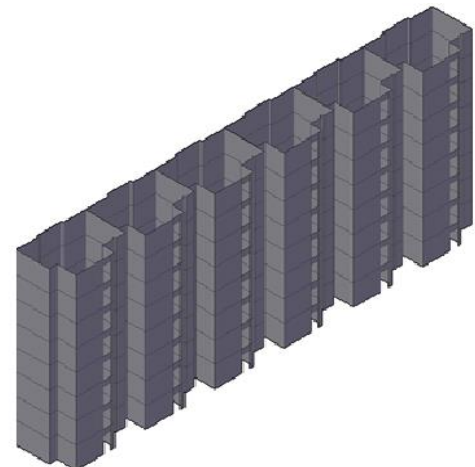


Figure.2 Precast View of the Building

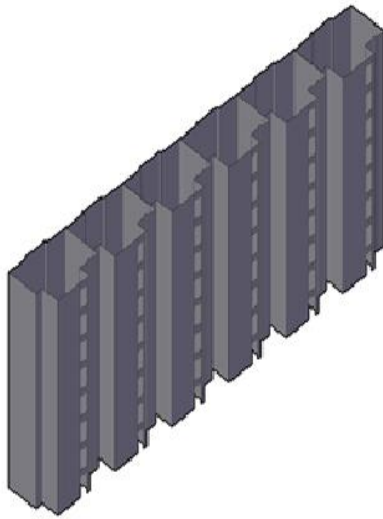


Figure.3 Conventional View of the Building

Scheduling is done for both precast and conventional construction using Primavera P6. The time for completion of project when it is done using precast method is 244 days while for conventional is 544 days. The estimation of quantities is done except for foundation. The slab cycle for precast building is 11 days. The time for completing one floor using conventional method is 30 days.

The quantity estimation is done based on the following- (i) The grade of concrete is M20 and the mix design for both precast and conventional is 1:1.5:3, (ii) The cement mortar is in the ratio 1:6, (iii) For precast construction, the quantity is estimated based on the volume of the panels, (iv) The quantity of materials required for foundation is not calculated, instead a sum of ₹10,00,000 is allotted in the rate analysis, (v) The floor to floor height is 3 m, (vi) This dimension of brick is taken as 190mm x 90mm x 90mm and, (vii) The cost of water for precast and cast in-situ are ₹50,00,000 and ₹1,00,00,000, this is due to the large quantity of water needed for cast in-situ. The volume of one house is 31.5 m³. For 48 houses, the total volume

is 1512 m³. As per the above regulations, the quantities of major components are as follows-

(I) For PreCast- Cement- 12096 Bags, Sand- 14742 cft, Steel- 12 tons, Aggregates- 31095 cft and GP2 Grout- 8064 bags.

(II) For Conventional- Cement- 9072 Bags, Sand- 62855 cft, Steel- 30 tons, Aggregates- 10000 cft and Brick- 9,82,800 nos.

The quantity of paint is found out as 1,230 liters which is split into 2 (for outer and inner). For outer, Tractor Emulsion is used and for inner Semi-Gloss is used.

The rate analysis is done based on the market rate in Bengaluru, India. A separate rate analysis is worked out for both precast and conventional, which includes the cost of the above mentioned components and water, plumbing, electrical, glass and window panes, tiles, door's and window's. The cost of materials which are given above are as follows- Aggregates- ₹3,900 per cubic foot, Cement- ₹280 per bag, Gp2 grout- ₹450 per bag, Sand- ₹960 per cubic foot, Steel- ₹42,000 per ton, Brick- ₹8 per number, Tractor Emulsion- ₹350 per liter and Semi-Gloss- ₹635 per liter. The labour charge is estimated as ₹600 per person per day. The cost for setting up the precast plant is estimated as ₹50,00,000. The cost estimated for equipment for both precast and cast in-situ are ₹35,00,000 and ₹10,00,000 respectively. A sum of ₹5,00,000 is added as miscellaneous amount. The cost of foundation, water, plumbing and sanitation, electrical, glass and window panes, tiles, door's and window's for precast is estimated to be ₹1,96,00,000 and for cast in-situ is ₹2,46,00,000.

The rate of constructing precast building is ₹18,31,28,275 and for conventional is ₹17,03,49,135. Also, the cost per house and cost

per sqft for both precast and cast in-situ are calculated.

The percentage difference of cost is calculated for difference in overall cost, difference in cost per house and difference in cost per square feet.

VI. RESULTS AND DISCUSSION-

1. Cost Comparison for completion of pre-cast and conventional is as follows:-

	Precast Construction	Cast in-situ	Difference in cost	%
Total Cost	18,31,28,275	17,0349,135	1,27,79,140	7.5
Cost Per House	38,15,173	35,48,940	2,66,233	7.5
Cost Per SqFt	2,765	2,572	193	7.5

2. Time required for completing pre-cast is 244 days and for conventional is 544 days.

VII. CONCLUSIONS-

1. Although, the cost for completion of Conventional Building is Less than 7.5% less than Pre-Cast Building, the days to complete exceeds by 300 days.
2. In span of constructing 1 conventional building, we can do 2 pre-cast construction, which eventually increases the profit.
3. The major outcome of this study is, although the initial amount of precast construction is high, it has advantage over cast in-situ as time consumed is less, which is a huge beneficiary.

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