Study on Comparison Between Prefabricated and Conventional Structures

Suraj kanase[1], Gajanan Gaikwad[2], Pravin Bhalerao[3], Shreyas Ladage[4],Prof.Pooja Chandgude[5]
[1, 2, 3, 4, 5] Dept of Civil Engineering
[1, 2, 3, 4, 5] Alard college of engineering and management marunji, pune

Abstract- *The growth of Indian construction is going to become a fast to fulfill the need of future generation, time effective and achieving advance technique. The paper based on time comparison of precast concrete vs. cast-in-place (i.e. traditional) concrete. How total time of construction by precast concrete system is less than the time by use of cast-in-place concrete. Time of any construction is directly varied with cost of construction. The time required for steel binding, shuttering, concreting then time required for curing will be minimize (7 days).The Precast is manufactured in factory (i.e. in controlled environment) with required quality, easily mix, and cure till achieved good quantity with desired strength. Precast concrete is manufactured in factory and transport to site.*

Keywords- Precast concrete, conventional, cost & time analysis.

I. INTRODUCTION

The construction industry is a complicated field full of uncertainties. For many years, people failed to optimize the construction sequence and encountered similar problems to manufacturing plants, such as a high share of non-value adding activities. Lean thinking was a real revolution in the manufacturing industry that originated in the 1950's and was gradually implemented in construction in the 1990's. Lean thinking helped manufacturing plants become more efficient and profitable by minimizing non-value adding activities and inventories, increasing overall quality and productivity and many more components that are discussed in this thesis. The approach was similar to the construction industry that followed the incorporation of lean methodology. Prefabrication seems to be the next step that the commercial construction industry will attempt to take in the USA, since it is able to combine lean techniques both in a manufacturing and a construction sense. Major construction companies like SKANSKA have attempted to investigate the potential of the field, implementing prefabrication techniques in a series of projects.

1.3 OBJECTIVES

- To study the Conventional &prefabricated building construction.
- To compare the conventional and prefabricated building construction with respect to time and cost.
- To determine which method will help to reduce on-site labour.
- To explore future opportunities in Precast Concrete Construction.
- To explore problems of implementation of precast Building technology.

1.4 LIMITATIONS OF STUDY

Capital cost to initiate construction is high and may require regular flow of funds.

- Post construction alterations are difficult.
- All the service lines are to be pre-planned in advance.
- Not much saving in construction in one storey structure.

1.5 SCOPE OF THE PROJECT

The scope of this study is to compare the conventional construction and precast construction and the results arrived based on the cost and duration of the project.

- Construction can be done effectively so that the overall construction cost could be saved.
- The time duration of the project can be minimized in precast construction.
- Generally resources wastage is common in construction. The effective construction process reduces the wastage of resources in large amount

1. 6 LITERATURE REVIEW

Isabelina Nahmens et al [1] investigated on UK housing market and their usage of prefabrication. Investigation of past experiences and existing knowledge of prefabrication has allowed several low cost techniques to be summarized. These

minimize the initial investment and increase the market value of UK house constructions.

Yingchen et al [2] suggested to choose prefabrication is highly based on experience and familiarity and personal preference rather than rigorous data. Methodical assessment of an appropriate construction method for a concrete project has been found deficient. This paper showcases a tool called construction method selection model. It helps to detect and evaluate the feasibility of a project in prefabrication at early stages.

Krish .R Villaitramani andDhruv .P Hirani [3] reported on deals with the slum clearance in Mumbai city. Benefits, Limitations and case study of mass housing by prefabrication method is successfully done. A review has been carried out in this paper to plan, analyze and design residential building using prefabricated techniques in Mumbai, bearing in mind, the cost of total construction and planning of the building are done in such a way that the maximum area utilization is achieved for minimum space and cost

N. Dineshkumar and P. Kathirvel [4] investigated on the present situation of precast in India. Suggestion for improvement and study of cost effectiveness for single and multi storey building. Literature survey was done between prefabricated and conventional structure. A detailed investigation on both types of construction was done.

OmidReza and Baghchesaraei [5] interprets that prefabrication systems might have some potential of increased use in future because of their characteristics. This paper clearly deals

V. Karthikeyan, E Vinodhini, P. Aparna, T. Monika, R. Sathish Kumar
http://www.iaeme.com/IJCIET/index.asp 3 editor@iaeme.com
with the standardization and customization involved in prefabrication. Standardization and Customization play such an important role in prefabrication construction process.

Alistair et al [6] suggested that throws light on how their new methods are evolving in selection of material and construction .This new method can improve productivity and quality of work. A New system is introduced termed as industrial building system (IBS). This comparison is done at a site in Thanjavoor .It helps provide an organised body for determining cost of construction.

PrajjwalPaudel et al [7] reported on the concept of modular structure, experiments, classifications, necessity of prefabrication and characteristics are explained. It is concluded with discussing in the benefits of prefabrication and rapid growth of this system in last 15 years

1.7METHODOLOGY

- Plan Preparation
- Data Collection
- Estimation of Quantities
- Cost Analysis
- Discussion
- Conclusion

1.7.1 PLAN PREPARATION

To estimate the quantities of conventional and prefabricated constructions.

1.7.2 DATA COLLECTION

In the data collection we can also know the procedures of the construction work and also find out the difficulties of the work. This collection is helpful to find out cost of the project for the both constructions. We also find the project duration of the construction by using these enquiries.

1.7.3 ESTIMATION OF QUANTITIES

Estimation is used to find out the requirement of the materials for both the constructions. The details of the materials which are used in the construction from the companies were collected. By getting these details we can estimate the quantities of the materials

1.7.4 COST ANALYSIS

This is the main factor which is considered in the project is to find out the comparison of cost analysis of building for the prefab construction and conventional construction. In this analysis we want to consider the resources of labor, material and machineries.

1.7.5 DISCUSSION

In this Study, we compare the cost and time taken for convention as well as prefabricated construction them through graphical representation and network diagram

1.8CASE STUDY

Name Of Project: Maharashtra state police housing and welfare corp.ltd.

Total plot area: 25863.00SQ.M.
Total built-up area (Permissible): 19396.95SQ.M
No. of flats: 132
Total project cost: 18.3Cr
Site location: F.P.NO.:Karad: 394
Address: Karve road, Tal-Karad, Dist- Satara.

VARIOUS PRECAST BUILDING COMPONENTS ARE AS FOLLOWS:-

- Columns
- Beams
- Staircase
- Lintel and chajja
- Siporex slabs and block

1.9RESULTS AND DISCUSSIONS

From that case study I have calculated cost for each precast and conventional framed structure like Column, Beam, Slab, Stair case, Lintels, Lintels with Chajja with the help of divisional schedule rate 2015-16, for precast components also include the erection cost per components. Basically cost is dependent on various factors such as material cost, labour cost,transportation cost, formwork cost, and erection cost etc.

COLUMN

Precast method

Precast column for M25 Grade

- Column Size = 0.35x0.35x2.820 M
- Total volume = 0.35 m3
- Steel required = 46 kg
- R.M.C rate for 1m3 concrete =5531 Rs.
- for 0.35 m3 concrete cost =(5531*0.3)=1936 Rs
- Labour cost for 1 column =125 Rs.
- Erection cost for 1 column =46 Rs
- Total cost required for 1 column
- Concrete=1936 Rs
- Steel cost=46*53.9(Rate/KG)= 2479 Rs
- Labour cost =125 Rs
- Erection cost =46 Rs
- Total column cost= 4586Rs
- Total no of column required for 1 floor 36 No's
- Total cost =4586*36 =165096 Rs
- 1m3 Rate for column =13103 Rs

Conventional Method

- Column Size = 0.35x0.35x2.820 M
- Total volume =0.35 m3
- Steel required=46 kg
- Conventional rate for 1m3 concrete= 8188 Rs.
- For 0.35 m3 concrete cost=8188*0.35 =2866 Rs

Total cost required for 1 column

- Concrete=2866 Rs
- Steel cost =46*53.9=2479 Rs
- Total column cost=2866+2479=5345 Rs
- Total no of column required for 1 floor 36 No's
- Total cost =5345*36 =192420 Rs
- 1m3 Rate for column =15271 Rs

BEAM

Precast method

- Precast Beam for M25 Grade
- Total volume of Beam =14.202 m3
- Steel required 2011.18 kg
- R.M.C rate for 1m3 concrete =5531 Rs.
- For 14.202 m3 concrete cost 78551Rs
- Labour cost for 57 beam = 42x57 =2394 Rs.
- Erection cost for 1 beam =22 Rs.
- Total 57 no's of Beam = 22x 57= 1254Rs.
- Total cost required for 57 no's of beam
- Concrete=78551Rs
- Steel cost =108403Rs
- Labour cost=2394 Rs
- Erection cost=1254 Rs
- Total beam cost =190602 Rs
- 1m3Rate for Beam =13421Rs

Conventional Method

- Total volume of Beam =14.202 m3
- Steel required = 2011.18 kg
- Conventional rate for 1m3 concrete 8237 Rs.
- For 14.202 m3 concrete cost =116982 Rs
- Total cost required for 57 no's of Beam
- Concrete=14.202*8237=116982 Rs
- Steel cost =2011.18*53.9=108403Rs
- Beam cost =225385 Rs
- 1m3 Rate for Beam =15870 Rs

LINTELS

Precast method

- Total volume of lintels =0.94 m3
- Steel required =72.16 kg
- R.M.C rate for 1m3 concrete =5531 Rs.
- For 0.94 m3 concrete cost =5199 Rs
- Labour cost =125 Rs.
- Erection cost for 1 lintel =40 Rs.
- Total 48 no's of lintels = 48x40 =1920 Rs.
- Total cost required for 48 no's of lintel
- Concrete=5199 Rs.
- Steel cost =3889Rs.
- Labour cost =125 Rs.
- Erection cost =1920 Rs.
- Total lintels cost =11133 Rs.
- 1m3 Rate for lintels=11844Rs.

Conventional Method

- Total volume of lintels =0.94 m3
- Steel required =72.16 kg
- Conventional rate for 1m3 concrete 8237 Rs
- For 0.94 m3 concrete cost =7743Rs.
- Total cost required for 48 no's of lintels
- Concrete=7743Rs.
- Steel cost =3889Rs.
- Total lintels cost =11632 Rs.
- 1m3 Rate for lintels=12374 R

SLAB

Precast method

- Total cost Required for 92 panels =200640 Rs
- Erection cost for 1 panel =15 Rs.
- Total 92 no's of panels = 15x92 =1380 Rs.
- Total cost required for 92 no's of panels
- Cost for slab panels=200640
- Erection cost =1380 Rs
- Total slab panel cost =202020 Rs
- Screeding of 40 mm
- Total volume of screeding =8.32 m3
- For 1 m3 m 25 grade rate of concrete=5531 Rs
- Steel required =630 kg
- Total Screeding cost
- Concrete cost=8.32*5531=46018 Rs.
- Steel cost=630*53.9=33957 Rs
- Total cost=46018+33957 =79975 Rs
- Total cost for slab =281995 Rs

Conventional Method

- Total volume of Slab =23.44 m3
- Steel required =2760 kg
- Conventional rate for 1m3 concrete =8843Rs.For 23.44 m3
- concrete cost =23.44*8843=207280 Rs
- Total cost required for Slab
- Concrete=207280Rs
- cost =148764Rs
- Total Slab cost =356044 Rs

LINTEL WITH CHAJJA

Precast method

- Total volume of lintels=0.78 m3
- Steel required =188.19 kg
- R.M.C rate for 1m3 concrete =5531 Rs.
- For 0.78 m3 concrete cost =4314 Rs
- Labour cost =125 Rs.
- Erection cost for 1 lintel with chajja=75 Rs.
- Total 28 no's of lintels with chajja = 2100 Rs.
- Total cost required for 28 no's of lintels with chajja
- Concrete=0.78*5531=4314Rs
- Steel cost=188.19*53.9=10143Rs
- Labour cost =125 Rs
- Erection cost=2100 Rs
- Total lintel with chajja cost =16682 Rs
- 1m3 Rate for lintel with chajja 21387Rs

Conventional Method

- Total volume of lintel with chajja =0.78 m3
- Steel required =188.19 kg
- Conventional rate for 1m3 concrete =9196Rs.
- For 0.78 m3 concrete cost =7173Rs
- Total cost required for 28 no's of lintel with chajja
- Concrete=0.78*9196=7173 Rs
- Steel cost =188.19*53.9=10143Rs
- Total lintels cost =17316 Rs o 1m3
- Rate for lintels 22200 Rs

STAIR CASE

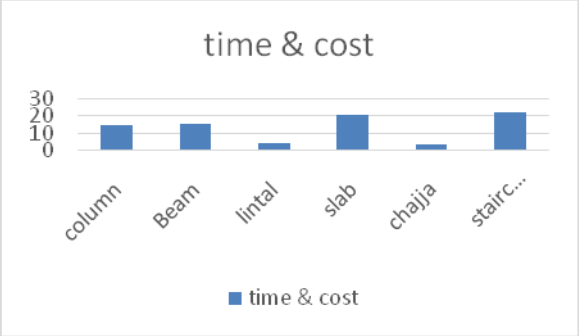
Precast method

- Total volume of staircase = 0.48 m3
- Steel required = 36 kg
- R.M.C rate for 1m3 concrete =5531 Rs.
- For 0.48 m3 concrete cost =2655 Rs
- Labour cost =125 Rs.
- Erection cost for 1 staircase =250 Rs.

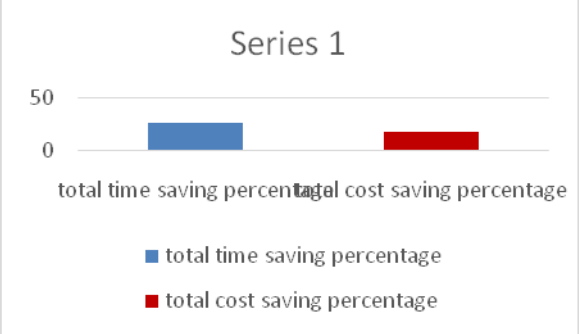
- Total 4 no's of staircase = 4x250 =1000 Rs
- Total cost required for staircase
- Concrete=0.48*5531=2655 Rs
- Steel cost =36*53.9=1940 Rs
- Labour cost =125 Rs
- Erection cost =250 Rs
- Total staircase cost =4970 Rs
- Total no of Staircase required for 1 floor 4 No's
- Total cost =4970*4 =19880 Rs
- 1m3 Rate for lintels 10354Rs

Conventional Method

- Total volume of Stair case =0.48 m3
- Steel required =36 kg
- Conventional rate for 1m3 concrete =9196Rs.
- For 0.48 m3 concrete cost =4414 Rs
- Total cost required for stair case
- Concrete=0.48*9196=4414 Rs
- Steel cost =36*53.9=1940Rs
- Total staircase cost=4414+1940=5354Rs
- 1m3 Rate for lintels 13238Rs
- Total no of Staircase required for 1 floor 4 No's
- Total cost =5354*4 =21416 Rs



This graph shows that the components wise cost comparison in percentage. Column reduces 14.2%, Beam 15.433%, lintel 4.29%, Slab 20.8%, lintels with Chajja 3.66% and Staircase 21.78%.



The above graph shows that the combination of cost saves per floor and time saving. From that the total time saving is 26% and the average components cost saving is 17.24%.

1.10CONCLUION

The fundamental objectives of the work have been accomplished. The aggregate cost and length have been resolved for both prefab and ordinary development .And additionally we had thought about the focal points and detriments of both constructionand traditional development by the overviewdirected. The examination shows there isn't a colossal cost contrast between the techniques (6%), prefab being more temperate in tall structures when contrasted with regular. In the meantime the prefab development diminishes the undertaking length, lessened by 335 days when contrasted with the ordinary. Because of overview we had realized that the prefab development have more points of interest and obtainment in industrialized, substantial frameworks. Materials that have turned out to be profoundly particular, with specialist vacillations in cost and accessibility, can be accumulated at construction shops or processing plants. Moreover, the institutionalization of building segments makes it workable for development to occur where the crude material is minimum costly.

REFRANCES

[1] IsabelinaNahmens and Michael A.Mullen (2011) "Lean Homebuilding: Lessons Learned from a Precast Concrete" Panelize Journal of architectural engineering, Vol. 17, No. 4, pp.110-153

[2] Yingchen, GulEokudan, David Rriley (2010) "Decision support for construction method selection in concrete buildings: Prefabrication adoption and optimization" Automation in Construction 19 (2010), pp. 665–675.

[3] Krish.RVillaitramani and Dhruv.PHirani (2014) "Prefabricated Construction for Mass Housing in Mumbai" International Journal of Innovative Research in Advanced Engineering (IJIRAE) vol 1 ISSN: 2349-2163, pp. 134-138

[4] N.Dineshkumar and P.Kathirvel (2015) "Comparative study on construction with cast in situ construction of residential building" ISSN 2348 – 7968, pp.527-532

[5] Omid Reza Baghchesaraei, AlirezaBaghchesaraei, MeltemVatanKaptan (2015) "Using Prefabrication Systems in Building Construction" International Journal of Applied Engineering Research ISSN 0973-4562 Vol 10, pp 44258-44262

[6] Alistair G. F. Gibb; and Andrew R. J. Dainty (2012) "Strategies for Integrating the Use of Off-Site Production

Technologies in House Building" Journal of Construction Engineering and Management ,Vol. 138, No. 11,pp.170-192

[7] PrajjwalPaudel, SagarDulal, Madam Bandar, Amity Kumar Tomar (2016) " Study on Pre-fabricated Modular and Steel Structures" SSRG International Journal of Civil Engineering (SSRG-IJCE) – Vol 3 Issue 5,pp.150-157

[8] Ninjalparekh and Bhupendra M Marvadi 'Comparative study of various construction techniques' – Journal of Information, knowledge and research in civil engineering, vol.3, No.2, pp.226-230.

[9] Siva Priya and Senthamil Kumar. S (2016),' Building cost comparison of precast vs conventional construction' – International Journal of Innovative Research in science, Engineering and Technology, vol.5, No.5, pp.8037-8044