

PRESENT APPLICATION OF RESOURCE MANAGEMENT IN PREFABRICATED AND IN-SITU CONSTRUCTION

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ABSTRACT

Currently, prefabricated building plays a leading role in construction. Mounting with the standardization and mechanization, Prefabrication has brought an extensive transformation in the construction industry around the world. Moreover the associated advancements to the local construction industry with the espousal of more mechanization, intelligent management systems and computer aided manufacturing; the wide-ranging use of prefabrication also contributes to sustainable development by means of cleaner and more resources saving production process. The main aim of this paper is to present a prefabricated construction based on time and cost utilization over than in-situ construction. Also forecast the general idea about the development and application of prefabrication method in the construction of large-scale and high-rise buildings. The factors like time and cost are analyzed in normal construction and in prefabricated construction companies. The results are shown by using management software tools.

KEYWORDS

In-situ construction, prefabricated construction, Quality, Time, Cost.

1. INTRODUCTION

For many years prefabrication has been used comprehensively and commonly over the world wide. The manufacture of building components are often illustrated by the terms such as prefabrication, pre-assembly, system building, industrialized buildings and modularization which are constructed on any like on site/off-site in an industrial unit covering modular, manufactured and pre-cut/pre-engineered systems. Although the conditions/terms, are normally used correspondingly, their specific definitions depend deeply on the users' experience and indulgent, which differ from countries to countries. In this paper, prefabrication is chosen with extra prominence on the building components which are made off-site in an industrial unit. Off-site fabrication is an area of international significance and provides an efficient construction technique in terms of time, quality, cost, productivity, safety and function. It is adopted globally as the ultimate resources of producing an enormous range of elements from cladding units, structural members and bathrooms to fully-finished modular buildings.

A General Review of Prefabrication Adopted in India, if the building materials are concrete, steel or timber based system, the benefits of prefabricated building systems must be obvious. It is an industrialized way of construction, with the inbuilt advantages of:

- **High capacity** - enabling the understanding of important projects
- **Factory made products**
- **Independent of unfavorable weather circumstances during construction**
- **Quality observation/surveillance system**
- **Shorter construction period** - below half of conventional cast in-situ construction.

Since the main goal of prefabrication is to consequence economy, enhancement in quality and speed in construction, the choice of proper materials for prefabrication is also a significant feature in the development of this technique. The use of locally existing materials with essential characteristics and also owing to their inherent characteristics such as easy workability/flexibility, light-weight, non-combustibility and thermal insulation, effect economy and enhanced quality may be tried in prefabrication.

In civil engineering projects, prefabrication saves engineering point in time on the construction site. This can be fundamental to the accomplishment of projects such as bridges and landslide galleries, where weather conditions may only permit short periods of construction. Prefabricated bridge systems and elements offer bridge designers and contractors considerable advantages in terms of construction time, safety, environmental impact, constructability, and cost.

Figure 1. shows the comparison between the In-situ buildings and the proposed prefabricated buildings in construction fields.

Factor	Prefabrication	On-site
Quality	Supports tentative weather climates and can give expected results	Tentative weather climate does not gives out expected results.
Speed	Speedy process (up to 70% less)	This type consumes more time may due to weather conditions.
Cost	Reduced cost due to greater control over manufacturing results	Scheduling and weather may increase the construction cost
Versatility	Less	More
Site refuse	Less waste	A large amount of waste is produced which also increases cost

Figure 1.1. Advantages of Prefabricated buildings over In-situ buildings

1.1. Time

Prefabrication can give way to save timings through the capability to carry out work concurrently on-site and off-site, in addition to helping with enhanced management with different traders. Additionally, less onsite performance, such as scaffolding, is regularly concerned. Regionally, the capacity to stay away from weather impacts can lessen construction time. Site conditions issue considerably in the facility of prefabrication to crash schedule.

Currently, Two-thirds of Construction firms which uses modularization /prefabrication observed that prefabrication reduces the schedule of the project up to 35% i.e., four weeks or more.

On difficult/complex projects to coordinate the use of prefabrication and modularization, extra time may be used up in the design phase. On the other hand, the time saved onsite normally reduces the whole project schedule.

1.2. Cost

As an outcome of using prefabrication/modularization, vendor report of project cost decrease ranging from 2% to 40%. A number of owners for these cheap costs consist of:

- **Possibly Local labors are very expensive or inefficient for onsite work.**
- **Costly delays may occur due to unfavorable onsite environment and weather troubles.**

cost related with onsite infrastructure and overhead can be reduced by relocating some or all of the work to an off-site locality as some owners statement . Furthermore they state that smaller number of workers onsite render to fewer costs for housing, scheduling onsite work and additional onsite logistics.

For prefabrication /modularization, labor costs can be a vital factor. Owners point out that prefabrication/modularization offers a less pricey alternative for very high local labor cost areas.

1.3. Quality

Quality control forms a primary part of precast construction. A proficient quality method is most significant in the accumulation making of precast components in every project. The quality control system implemented in a precast industrial unit is discussed in this study.

The precast industrial unit is set up for the production of large scale buildings. Processes in the precast production are proposed with respect to the quality control procedures in the quality inspection plan. The standard tests like concerned roles of inspectors and corrective actions onsite are tinted. Serious issues pertaining to the quality and productivity of precast manufacture are reviewed. These consist of the quality of maintenance and staff, which possibly will potentially have an effect on the effectiveness of the quality system. Various considerations are supposed to also be given to develop the workflow and efficiency of the factory.

2. NEED FOR STUDY

In the current situation the construction of buildings are very difficult thing around the world due to over contest and necessities of client requirements. Quality of On-site buildings are mainly affected by several reasons like poor quality of materials, environmental factors, wastage of materials, etc... This proposal will used to recognize factors for good quality of production/ construction at low cost.

3. OBJECTIVES

- To Study on efficient deployment of Cost in Prefabricated and In-situ buildings.
- To Study on efficient exploitation of Time in Prefabricated and In-situ buildings.
- To Study on Quality of prefabricated and In-situ buildings.
- Making a Study about the methodology adopted in the manufacturing of prefabrication construction.
- Management of Resources in Prefab and In-situ construction using Software.
- To study on comparison of Duration, Cost, and Quality of prefabricated and In-situ buildings.

4. LITERATURE REVIEW

Based on the Prefabrication literatures are collected. From the review various factors were recognized. The literatures together are being used as base for the further procedures in the project.

The author [1] Christabel M F Ho, Raymond W M Wong., emphasizes that

- Mass production prefabricated building components (precast façade, precast stair flight, drywall and semi-precast floor planking) reduce cost and save time, with added advantage of taking some of the most dirty and awesome work out of the process.
- Faster erection capabilities and fewer manpower requirements make prefabrication the most viable option for public housing construction in Hong Kong.
- According to the study carried out by Tam (2002), there could be a 43 percent reduction in site labor consumption if there is a shift from the in-situ site casting to prefabrication design.

At the same time, prefabrication offers clients better performance to fulfill all requirements, such as:

- Opportunities for good architecture
- Fire resistant material
- Healthy buildings
- Reduced energy consumption through the ability to store heat in the concrete mass
- Environmentally friendly way of building with optimum use of materials, recycling of waste products, less noise and dust etc.

The authors Linda Brock, James Brown [2] stated that,

- In Canada, manufactured housing simply means that 85 percent or more of the construction is completed in a factory.
- In fact, 24 percent of new housing starts in 1996 were manufactured-mobile houses; only 2 percent to 3 percent were other prefabricated styles (such as modular housing).
- In the same year in Canada, all styles of prefabricated homes represented only 7.5 percent of the market, with two-thirds of these homes being single modules.

Shri P K Adlakha, Shri H C Puri [3] describes prefabrication as In India, adoption of prefabrication building techniques has many merits in the context of availability of materials, labor and technical skills. Advantages of prefabrication are:

- In prefabricated construction, as the components are readymade, self supporting, shuttering and scaffolding is eliminated with a saving in shuttering cost.
- In traditional construction, the repetitive use of shuttering is limited, as it gets damaged due to frequent cutting, nailing etc. On the other hand, the mould for the precast components can be used for large number of repetitions thereby reducing, the cost of the mould per unit.
- In prefabricated housing system, there is saving of time as the elements can be casted before hand during the course of foundations being laid and even after laying slab, the finishes and services can be done below the slab immediately. While in the conventional in-situ RCC slabs, due to props and shuttering, the work cannot be done, till they are removed. Saving of time means saving of money.
- In prefabricated construction, there is better quality control, shape and size of precast elements. Therefore, in structural design, full advantage of properties of cement and steel can be exploited.
- In precast construction, similar type of components is produced repeatedly, resulting in increased productivity and economy in cost too.
- In precast construction, the construction is not affected due to weather, rain, wind etc

5. METHODOLOGY

With the intention to get the details associated to prefabricated construction uses along with their safety procedure and different methods of production literature study and the study of codes and regulation were prepared. The flowchart below represents the methodology adopted for the proposed work. After reviewing the literature the industry/company where the work is to be adopted is identified. Then the data's from the industry/company are collected and analyzed.

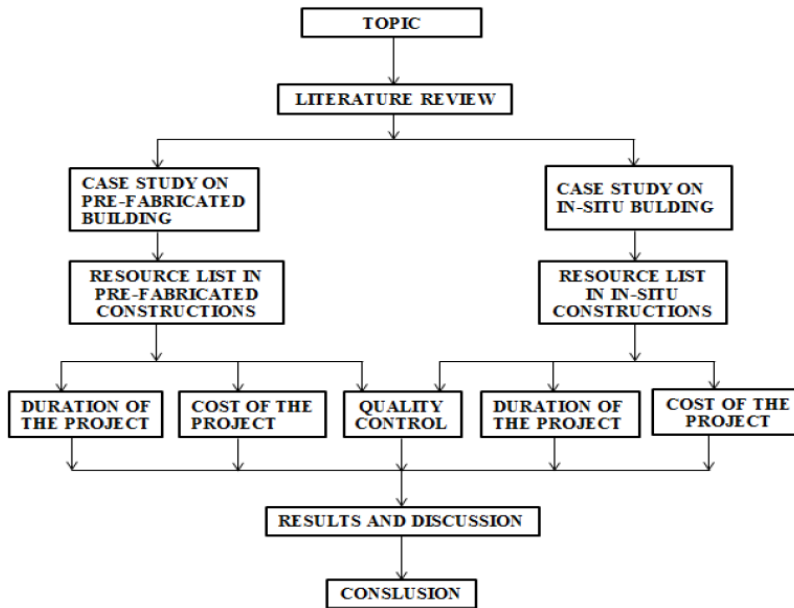


Figure 5.1. Work Flow Diagram

6. CASE STUDY ON IN-SITU BUILDING

Raj Associates has plans to build a multi-storeyed construction in the main area of the city. In building construction bunch of work packages and activities are mixed up. Making an effort to use the resource optimistically and also to lessen the time and cost. The activities for customizing different functional areas are declared as work packages and their relationship are specified.

6.1.Stages Of Work

- General condition
- Procurement of materials
- Site preparation
- Arrangement of site
- Work on foundation
- Erection of structures
- Steel erection in 2 & 3 floor
- Plumbing work
- Work on roofs
- Installation of windows
- Finishing of building
- Final clean-up and occupation
- Works on floor
- Final inspection

Table 6.1. Stages of Work for In-situ building

Task name	Duration	Cost
General condition	14 days	₹ 97,583.33
Procurement of materials	18 days	₹ 179,000.00
Site preparation	13 days	₹ 117,000.00
Arrangement of site	17 days	₹ 200,450.00
Work on foundation	46 days	₹ 345,350.00
Erection of structures	24 days	₹ 122,250.00
Steel erection in 2 & 3 floor	73 days	₹ 405,550.00
Plumbing work	6 days	₹ 58,200.00
Work on roofs	17 days	₹ 92,600.00
Installation of windows	16 days	₹ 106,400.00
Finishing of building	18 days	₹ 62,850.00
Final clean-up and occupation	38 days	₹ 203,950.00
Works on floor	22 days	₹ 109,900.00
Final inspection	6 days	₹ 32,006.00
TOTAL	347 days	₹ 2,096,189.33

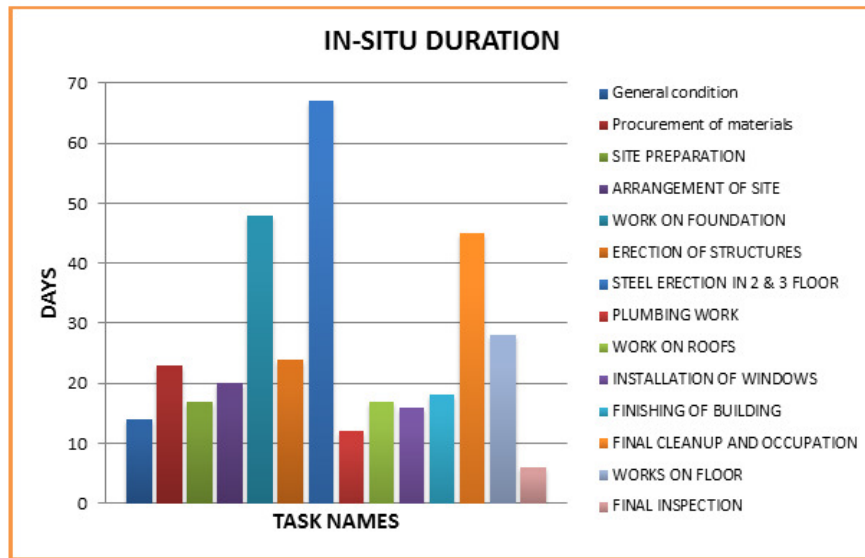


Figure 6.1. Duration of Project

Total duration of the Institutions building is 347 days.

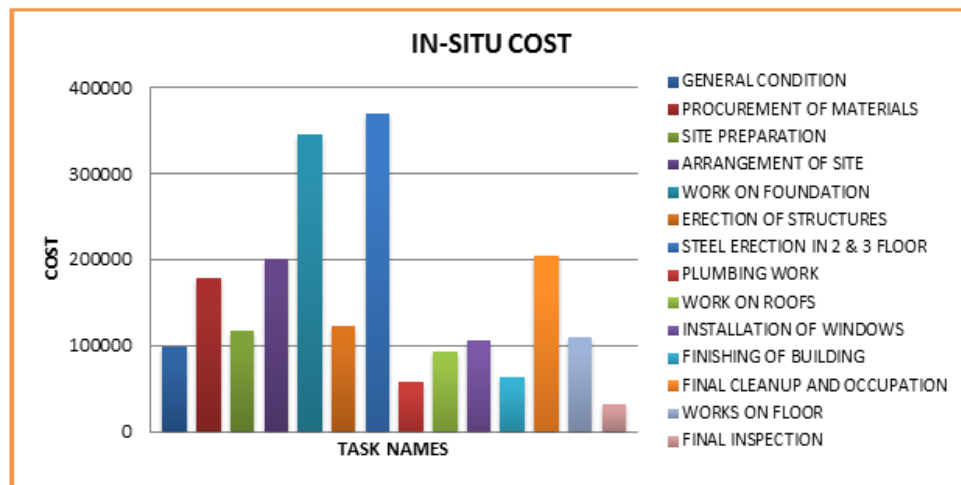


Figure 6.2. Cost of Project

Total budget of the In-situ building is Rs. 2,096,189.33/-

7. CASE STUDY ON PREFABRICATED BUILDING

Teemage Precast Pvt. Ltd. plans to build a multi-storeyed construction in the main area of the city. In building construction bunch of work packages and activities are mixed up. Making an effort to use the resource optimistically and also to lessen the time and cost. The activities for customizing different functional areas are declared as work packages and their relationship are specified.

7.1. Stages Of Work

- General condition
- Procurement of materials
- Site preparation
- Arrangement of site
- Work on foundation
- Erection of structures
- Steel erection in 2 & 3 floor
- Plumbing work
- Work on roofs
- Installation of windows
- Finishing of building
- Final clean-up and occupation
- Works on floor
- Final inspection

Table 7.1. Stages of Work of prefabricated building

Task Name	Duration	Cost
General condition	5 days	₹ 38,500.00
Procurement of materials	20 days	₹ 147,750.00
Site setting	16 days	₹ 87,500.00
Site preparation	6.5 days	₹ 37,200.00
Preparation of foundation	4 days	₹ 13,300.00
Erect beams, columns for ground floor	6 days	₹ 294,800.00
Erection in first floor	7 days	₹ 431,400.00
Staircase erection (b/w ground and 1 st floor)	1 day	₹ 147,600.00
Erection in second floor	7 days	₹ 563,300.00
Staircase erection (b/w 1 st and 2 nd floor)	1 day	₹ 147,100.00
Erection in Third floor	7 days	₹ 709,000.00
Staircase erection (b/w 2 nd& 3 rd floor)	1 day	₹ 147,100.00
Erect parapet wall & store room	5 days	₹ 437,700.00
Final clean-up and occupancy	24.5 days	₹ 116,675.00
Flooring	10.5 days	₹ 34,425.00
Final inspections	5 days	₹ 29,750.00
TOTAL	126.5days	₹ 3,383,100.16

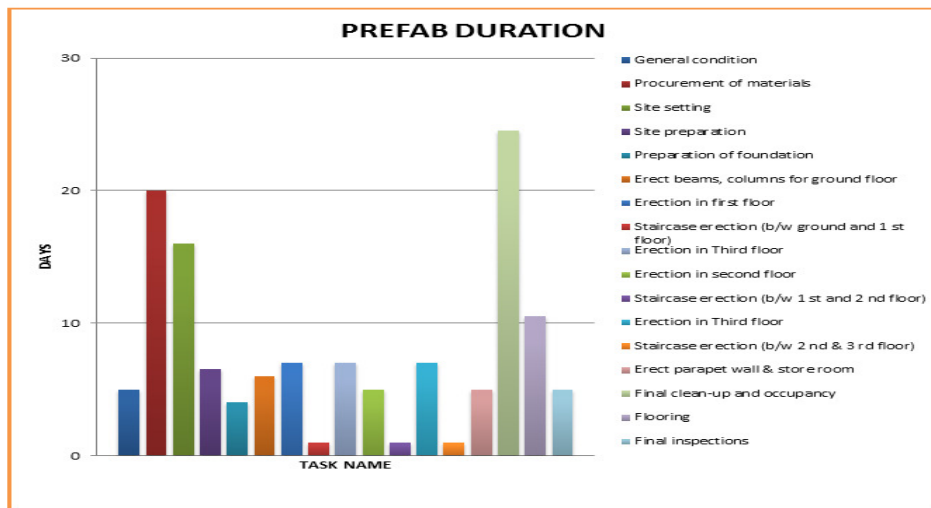


Figure 7.1. Duration of Prefabricated Building

Total duration of the prefabrication building is 126.5 days.

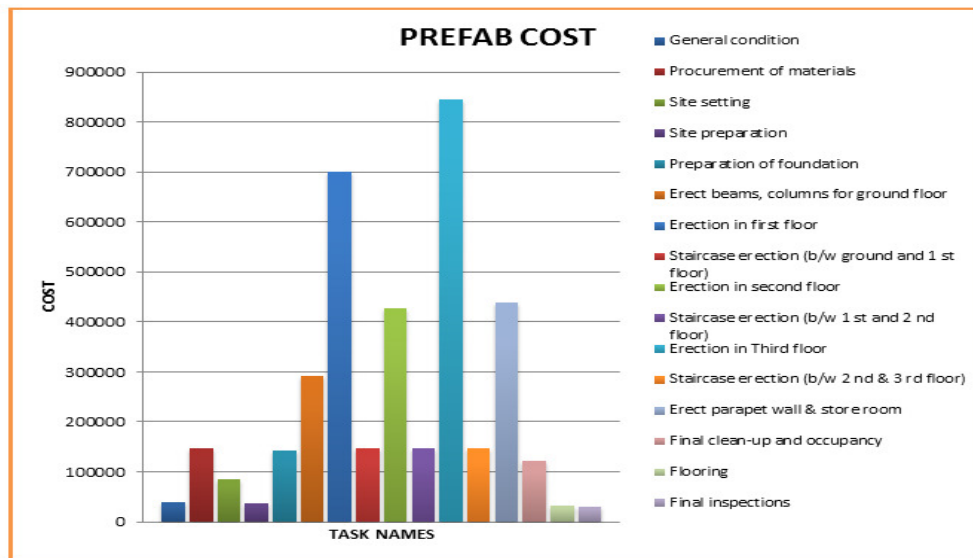


Figure 7.2. Cost of Prefabricated Building

Total budget of the Prefabrication building is Rs.3,383,100.16/-

8. RESULT

From the above case studies the following results are obtained.

- In this research the aim is to achieve low cost and time than In-situ construction. We obtain a time and cost utilization in prefabricated construction when compared to in-situ construction.

- The time and duration requirements of the construction activities are determined from prefabricated construction and in-situ construction.
- Data's are analyzed by means of management software Tools like MS Project 2010.
- Project schedules are decreased by 75 % compare than in-situ- construction.
- Project budget are increased by 31% compare than traditional construction like In-site.

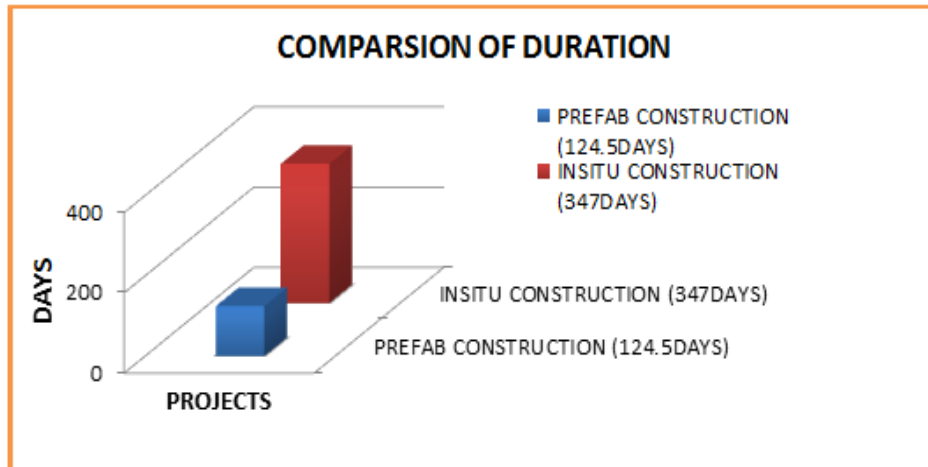


Figure 8.1.ComparisionOf Duration Between Pre Fabricated And Insitu

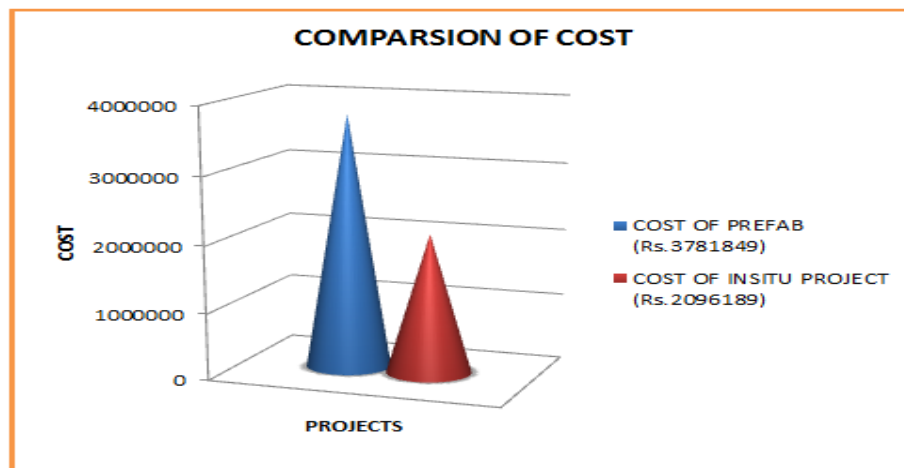


Figure 8.2.ComparisionOf Cost Between Pre Fabricated And Insitu

9. SUGGESTIONS

Based on the literatures and case study, the subsequent suggestions are used to get better performance of construction projects.

- In civil engineering projects, prefabrication saves engineering point in time on the construction site. This can be fundamental to the accomplishment of projects such as bridges and landslide galleries, where weather conditions may only permit short periods of construction. Prefabricated bridge systems and elements offer bridge designers and contractors considerable advantages in terms of construction time, safety, environmental impact, constructability, and cost.
- Prefabrication can yield time savings through the ability to conduct work simultaneously on-site and off-site, as well as helping with better coordination among different traders. In addition, less onsite staging, such as scaffolding, is frequently involved. Regionally, the ability to avoid weather impacts can reduce construction time.

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