Impact of Prefabrication Construction Method on Profitability

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Abstract - *Prefabrication has brought a considerable modification within the development of industry worldwide over the previous few decades. It ensures the strength, economy and environmental performance of the structures and therefore is most well-liked over the onsite construction. Pre-assembly, prefabrication, modularisation, system buildings and industrialized buildings area unit the varied terms used to describe the processes of producing of modular units on-the-site or off-site There are numerous kinds of standard prefab building construction techniques used worldwide.This is fast construction of large numbers of building units at a lowest value. It's referred as off-site construction and fabricating of some or all components of structure in industrial units, and transporting and assembling them to the development site wherever the building is to be created.*

Key Words*: *Prefabrication, Modularisation, Off-site construction, Lowest value

1. INTRODUCTION

Prefabrication has been widely considered as a sustainable construction technique in terms of its impact on environmental protection. One vital aspect of this perspective is the influence of prefabrication on construction waste reduction and therefore the future waste handling activities, together with waste sorting, reuse, recycle, and disposal. Never the less, it would appear that existing research with regard to this topic has failed to take into account its innate dynamic character of the process of construction waste minimization; desegregation all essential waste handling activities has never been achieved to date. This report proposes a dynamic model for quantitatively evaluating the potential impacts arising from the application of prefabrication technology on construction waste reduction and therefore the future waste handling activities.

1.2 Objectives

- To study construction process of prefabrication systems.
- To compare prefabrication construction with conventional construction in terms of cost, work breakdown structure and feasibility.
- The object of this to identify new methodologies within the Construction industry.
- To identify the cost benefit analysis to change parts of RCC building with prefabrication parts for instance doors and windows frame, prefabrication walls, W.C., bath and staircase,etc by using Microsoft Project.

1. 3 Advantages

1. **Eco-friendly:**
   - Prefab construction is usually recommended for energy efficiency and sustainable construction. Conventional construction ways need additional materials that cause redoubled waste. However, since prefab sub-assemblies created in factory, additional materials are often recycled in factory.
   - The controlled environment of a factory allows more accurate construction, tighter joints and better air filtration, which allows for better wall insulation and an increase in energy efficiency.
2. **Financial Savings:**
   - Prefab construction targets all budgets and price points, creating an affordable option.
   - Prefab manufacturers often receive bulk discounts from material suppliers which then down the cost of a construction project.
   - The reduction in construction time can significantly save on construction financing costs by lowering labour cost.
3. **Flexibility:**
   - Prefab construction will be simply be disassembled and relocated to completely different sites.
   - Prefab reduces the demand for raw materials, minimizes spent energy and decreases time overall.
4. **Consistent Quality:**
   - Prefab construction occurs in a controlled manufacturing environment and follows specified standards, the sub-assemblies of the structure will be built to a uniform quality.

5. **Reduce Site Disruption:**
   - Several components of a building are completed in the factory, there is cosiderably less vehicle traffic, equipment and material suppliers around the final construction site. This limits the disruption of traditional job sites that suffer from noise, pollution, waste and other common irritants.

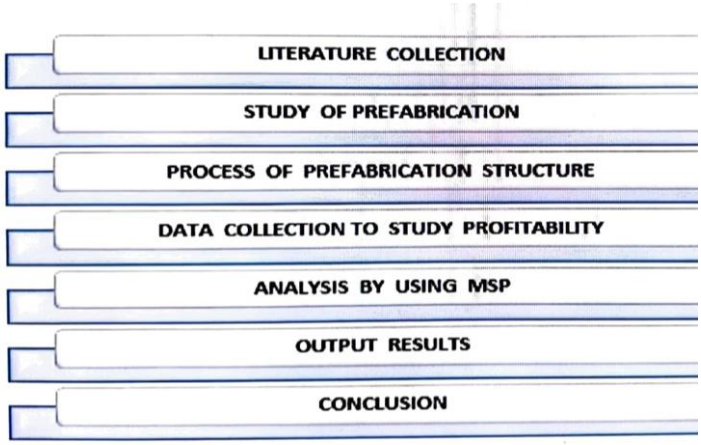
6. **Shorter Construction Time:**
   - Due to better upfront planning, elimination of on-site weather factors, contractor scheduling delays and quicker fabrication as multiple pieces can be constructed simultaneously this results in shorter construction time.

7. **Safety:**
   - sub-assemblies are created in a factory-controlled environment utilizing dry materials, there's less risk for issues related with moisture, environmental hazards and dirt. This ensures that those on the construction site, as well as a project's eventual tenants are less likely to be exposed to weather-related health risks. Also, an indoor construction environment presents significantly fewer risks for accidents and other liabilities.

1. 4 Disadvantages

- At joints in prefabricated components leakage occurs.
- Transportation costs may be high for huge prefabricated sections.
- Initial construction cost is higher.
- The initial design development is time consuming.
- Huge prefabricated sections need heavy-duty cranes and accuracy measurement from handling to place in site.
- Local jobs may be lost, as it requires skilled labour.
- Design and construction of modular buildings, require high levels of collaboration among project parties, especially architect, structural engineer and manufacturer.
- Due to its shorter economic life these buildings typically depreciate more quickly than traditional site-built housing

2. METHODOLOGY



2.1 Study of Prefabrication

Prefabrication is that methodology of construction which includes assembling elements of a structure in a manufacturing or production site, transporting complete assemblies or partial assemblies to the site wherever the structure is to be located. It's combination of good design with trendy high performance components and quality controlled during manufacturing procedures.

2.2 Process of Prefabrication Structure :

Prefabrication is done in 2 stages-

1. Manufacturing of component at factory condition
2. Erection of components at planned location.

Stages of preparation:

I. **Casting -**Precast components are casted with controlled cement concrete in moulds having required shape and sizes. The vibrator is used to vibrate concrete and this removes air and any honeycombing inside the components.

II. **Curing -**After 24 hours of casting, the casted components are released from the mould and transported to curing tanks. Certain special components like railway sleepers where high strength is required are steam cured.

III. **Transportation and erection -**After complete curing is done the components are transported to the site with the help of heavy vehicles and erection will be done using cranes with skilled labour force.

Fundamentals of Prefabrication:

1. Modularization
2. Prefabrication

3. Preassembly
4. Industrialization

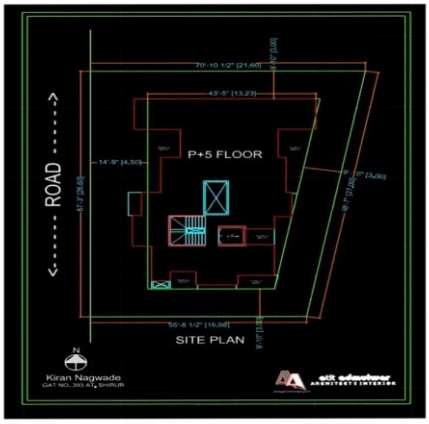
Prefab Components:

- Flooring / Roofing system.
- Precast Beams
- Precast Columns
- Precast wall panels
- Precast Slabs
- Prefab doors and windows

Why precast construction is unpopular in India:

- Contractors' prefer for employing low cost labour over high capital investment.
- Lack of appropriate transportation systems is main obstacle for precast technology as large precast elements are transported from factory to construction site for erection.
- Less level of standardization of technology.

3. STUDY OF PROFITABILITY BY COMPARING THE COST OF CONVENTIONAL CONSTRUCTION METHOD AND PREFABRICATION CONSTRUCTION METHOD



- Name of site: Shivsai developers
- Name of builder : Kiran Vitthal Nagawade
- Location of site: Plot no. 25&26 at nhawaretal. Shirur, dist. Pune
- Area of site : 6000 sq.ft.
- Cost of project : 1.8 Cr
- Name of consultant : Mahesh kadam
- Details of site :
  - 2bhk - 3 flats per floor
  - 1 bhk - 2 flats per floor
- Present condition : excavation and preparation for centre linning for foundation
- Total built up area : 4800 per floor slab area (P+4)
- Owner and developer : Kiran Nagawade
- Architect : Sidhesh Sonawane
- Structural engineer ; Sachin Sharma
- Total flats : 20 flats
  - 12 flats : 2bhk
  - 8 flats : 1bhk
- This structure is conventional residential building. These case study having 20 flats and it is having (P+4) structure.

Type	Duration	Cost
Conventional Construction	484	19610000
Prefabrication Construction	412	19070000

Table 3.1 Summary of Time and Cost for Conventional Construction and Prefabrication Construction with Percentage saving

	Activities	Time			Cost		
		Conventional (days)	Prefabrication (days)	Saving (%)	Conventional (Rs.)	Prefabrication (Rs.)	Saving (%)
1.	Walls	45	10	77.78	12,93,500.00	9,93,500.00	23.20
2.	WC Bathroom	15	20	-33.33	10,97,555.00	9,97,555.00	9.12
3.	Door window	18	15	16.67	7,32,000.00	6,32,000.00	13.66
4.	Staircase	58	19	67.24	4,90,390.00	4,50,390.00	8.16
	TOTAL	**136**	**64**	**52.94**	**36,13,445.00**	**30,73,445.00**	**14.95**

Analysis by using Microsoft Project

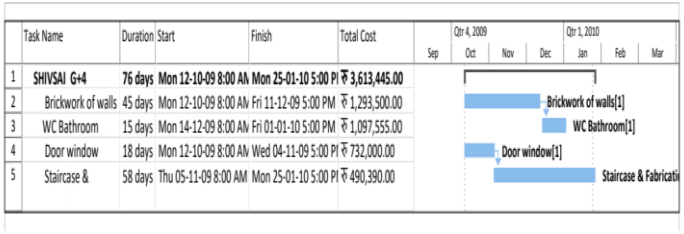


Fig-1: Work Breakdown Structure of specific components in Conventional Construction in MSP

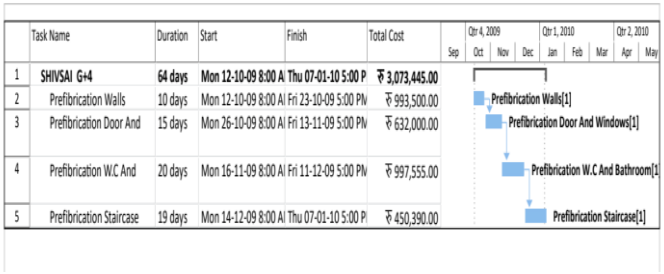


Fig-2: Work Breakdown Structure of specific components in Prefabrication Construction in MSP

4. CONCLUSIONS

- The study of prefabrication process is done which founds that prefabrication reduces activities related with repetitive body movements, ergonomic challenges & ergonomic problems & 92% workers reported that use of prefabrication preassembly reduce hazards related to material handling on site & that reduction of scaffoldings through use of prefabricated preassembly or precast components would lead to less fall on site.
- The comparative survey of conventional construction with prefabricated construction found that conventional construction requires 1.96 Cr rupees & 484 days to complete construction while 1.90 Cr rupees & 412 days required for prefabrication construction which shows that prefabrication process saves time by ~ 53% and cost by ~ 15% required for completion of construction.
- In this way we found that prefabricated material reduces time as well as cost required to project for completion.
- By changing parts of RCC building with prefabricated parts like prefabricated walls, w/c, bath, staircase, doors & window frames we come to conclusion that prefabrication construction reduces time as well as cast required to project for completion.

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