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Time and Cost Analysis using Prefabrication for Construction Industry

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ABSTRACT: Resource scheduling is a key step of project management. Resource scheduling refers to these actions & methodology used by organizations to efficiently assign the resources. They have to jobs, tasks or projects they need to complete & schedule start & end dates for each task or project based on resource availability. A resource schedule will show which resource is assigned to which task. Planning and scheduling helps in future situation and implementation of project scheduling using MSP gives good controlling and clear schedule to a project. Depending on industry, resources can be people (either employees or independent contractors), equipment and machines (this is frequent for construction, manufacturing or maintenance businesses) or rooms and facilities. Today the need is to save time and to optimize the utilization of resources. This method requires large amount of time and labor at project site. For this purpose it is very essential to make schedule of resources so as to reduce time and cost of overall project. Resource scheduling reduces the unexpected loss of the project which may be caused due to the huge variations in the usage of the resources.

KEYWORDS: Conventional, Prefabricated, Optimization, MSP, scheduling, resource management, construction projects.

I. INTRODUCTION

Now a days there is great boom in infrastructural development that to in a manner of fast-track construction. Today the need is to save time and to optimize the utilization of resources. This method requires large amounts of time and labour at project site. Buildings form an important component of infrastructure, and require huge investment. Overall, building construction is a labour-intensive, lengthy process primarily due to curing times for concrete and formwork construction. Using prefabrication in a project allows to reduced time duration. This means that the impact of the site on the local environment is for a shorter period of time. Using this prefabricated building components in building construction projects can reduced the curing times from the critical path of the project and eliminating the need for temporary formwork. Thus the purpose of this project is to determine prefabrication and onsite trends and effects on the construction workforce. Therefore, using of these techniques to reduce project duration, & costs. Study of comparison between onsite construction and prefabricated construction and show the graphical representation. The aim of this project is to determine the prefabricated building techniques over a conventional method. Prefabrication techniques have many merits, like availability of materials, labour, and technical skills. Advantages of prefabrication are multiple as the components are readymade and 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 a large number of repetitions, thereby reducing the cost of the mould per unit. In the prefabricated housing system, there is saving of time, as the elements can be cast beforehand during the course of the foundation being laid.

In this research work first identifies the functionality of Conventional construction and prefabricated construction approach and find out which is the best between them base on cost, time, finance etc.

II. LITERATURE SURVEY

System [1] contributes to the analysing cost and time-savings, and productivity improvement achievable by the use of prefab in place of the conventional method. Records of completion times and final contract values of 66 building projects implemented using prefab in Auckland were collected. The building types included commercial, houses,

apartments, educational, and community buildings. Based on these details, the equivalent completion times and the final cost estimates for similar buildings implemented using the conventional method. Investigations were focused on exploring the potential marginal time and cost savings that could be achieved by the use of prefabricated system over and above the outcomes for conventional building system. Major finding was Marginal cost saving delivered by the prefabricated system over the conventional.

According to [2] discusses the case of Mumbai, the city of maximum slum population density in the world, where prefabrication can be a promising solution to housing scarcity. Case study was done on a housing project based on prefabrication technique by TATA group. These houses have an area of 20-30 sqmetres and lifespan of 20 years. Their main findings were less wastage of materials can be achieved due to controlled environment in prefabricated construction and higher quality control can also be achieved. Prefabricated construction is less labour intensive due to Computer Integrated Manufacture (CIM).

The system [3] purpose of this research was to identify prefabricated residential construction products or methods from the U.S. that can be used for developing new or similar products that are compatible with the Thai market. Case study research method supported by various books published in both countries was adopted for this research. Information about cost, time and prefabricated content of completed commercial building projects provided the data for this study. Market survey was conducted to analyse the scope of prefabrication in Thailand. The main findings were American prefabrication should do well in many developing Asian countries, including Thailand. The key to success for American prefabricated products in Thailand is that most of them have strengths over most of the existing Thai prefabricated products in the market. Energy saving and easy assembly are two main key which make American prefabricated products interesting and competitive with the local products. Good products or high quality products are not always the most desired products. American prefabricated products absolutely have better standards than many local prefabricated products. However, not all the high standards are required or attract local buyers.

Resource scheduling of construction project: case study states by RhutaJoshi, Prof. V.Z. Patil [4] Explains Several construction activities can be managed to achieve the profit within limited funds and time. Thus project management techniques are useful in scheduling and coordinating the various resources by controlled method. Management techniques such as Critical Path Method, Program Evaluation and Review Techniques (CPM/PERT) have been successfully implemented prior to the 1970's, in various Civil Engineering projects in the countries like USA, Canada, Australia. These techniques help management in efficient and economic use of resources for completion of project objectives with unlimited availability of resources, though it is observed that resources are limited in real project scenario. It has been observed that the project delays occur due to insufficient supply of resources. In large scale projects, preparing an accurate and workable plan is very difficult. Computer packages like MS Project and Primavera project planner are used in construction industry. Project management techniques can be used to resolve resource conflicts and also useful in minimizing the project duration within limited availability of resources to make the project profitable. The main aim of this study is to analyze the Project management techniques by scheduling various construction activities, allocation of resources and resource leveling using Microsoft Project 2013 for residential building. This paper analyzes resource constrained project using Microsoft Project 2013 by resource leveling and compares the time cost implications with scheduled time and estimated cost.

This study describes [5] additional structural challenges of high rise construction make modular construction in this setting more challenging, but the high construction costs of high rise construction also make any savings in time and hard cost worth consideration. Based on case studies, interviews and financial simulations this paper will address the design, engineering, sustainability, scheduling, legal and financial considerations a developer would likely consider in adopting modular construction in a high rise project in the United States. Interviews were conducted of adopters, manufacturers, contractors, industry representatives and lenders that would likely be involved in the development of a high rise modular project. There are numerous project benefits to modular construction, but the most prevalent are time savings, cost savings and more sustainable construction.

This review presents the [6] challenges faced by the construction industry to integrate the prefabricated construction with the existing traditional method and to make the comparative study among the three countries; United Kingdom, Australia and Malaysia. Malaysia applied industrialized building system (IBS), modern method of construction (MMC) is the term used by the United Kingdom. Offsite manufacturing (OSM) is the term used for Australian and UK construction industries. This research studies the pattern of MMC, OSM and IBS to identify the pattern research scholars in the three countries and precast concrete system become popular system. Review of various Government



policies in these countries emphasizing on Prefabrication by various research scholars and comparison of them. This research manages to determine the application of prefabrication by the pattern of prefabrication construction, physical and social factors for implementation IBS, MMC and OSM. Precast concrete system is the most popularly used in the IBS industry as well as for the UK and Australia scholars have stated to encourage applied the precast concrete system.

III. RESEARCH METHODOLOGY

1 General

This phase presents the method of the study on comparison of prefabrication construction with conventional construction. A residential building is taken for comparing and it includes the preparation of plan, data collection from precast industry, estimation of quantities, and determination of project duration.

2 Plan Preparation

Plan preparation is done for residential building to estimate the quantities of conventional and precast constructions. Double storey building is taken to estimate the quantities.

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. The estimation of quantities for the double storey building is presented in table 1 and 2.

4 Project Duration

Project duration of the each construction was collected from the similar companies and compares the time of completion period by using Critical Path method with Primavera P6. Table 3 and 4 gives the project duration of precast and conventional construction of the building.

5 Cost Analyses

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

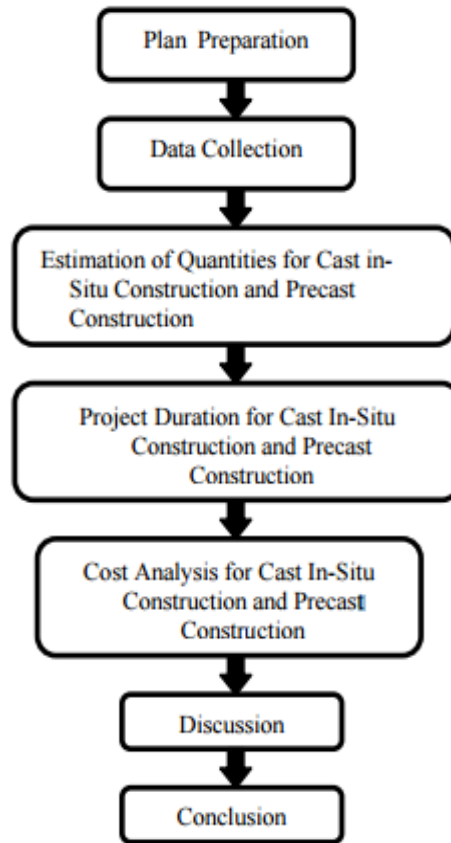


Figure 1: Flow of proposed research methodology

IV. RESULTS AND DISCUSSIONS

Calculations for Conventional construction method

Calculations for each activity task of conventional construction as per DSR 2019-20 For Nasik region :-
 Cost of each task :- No. of Resources × Rate of resource per day × No. of days required to complete task Similarly all remaining calculations for task activities are done by the above same way.

Payments for resources as per District Schedule Rate (DSR) 2019-20 for Nasik region are as below :-

Table 1 : Resources and cost

Sr. No.	Resources	Rate per day
1.	Labour	550
2.	Mason	600
3.	Carpenter	800
4.	Barbendor	700
5.	Electrician	850
6.	Skilled Labour	700



Table 2 : Resource Table on Conventional Construction Method

Resources	Rate/day	No. of Workers	Total Cost
Labour	550	3150	1732500
Mason	600	830	498000
Bar Bender	800	366	292800
Carpenter	700	186	130200
Electrician	850	123	104550
Skilled labour	700	1875	1312500
40,70,550			

Above table describes that resources required for completing a schedule of G+ 5 conventional methods. Here total cost observed to be 40,70,550Rs. This cost to be find out by calculating how resources to be allocated to each activity for particular duration.

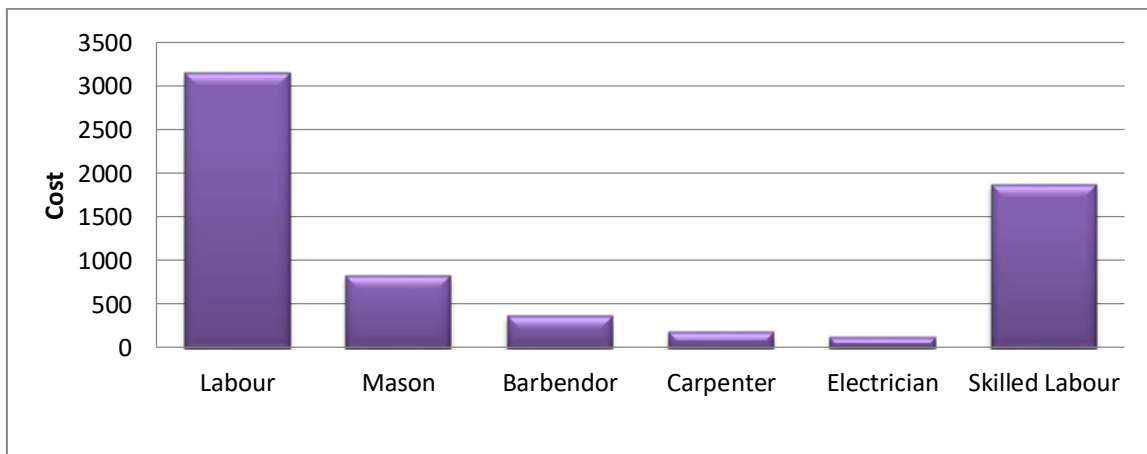


Figure 2: Resources Chart for Conventional Construction Method

Prefabrication Construction Calculations-

Calculations for each activity task of Prefabricated construction as per DSR 2019-20 For Nasik region :-

Cost of each task :- No. of Resources × Rate of resource per day × No. of days required to

Similarly all remaining calculations for task activities are done by the above same way.

Table 2 : Resource Table on Prefab Construction Method

Resources	Rate/day	No. of Workers	Total Cost
Labour	550	2896	1592800
Mason	600	760	456000
Bar Bender	800	302	241600
Carpenter	700	144	100800



Electrician	850	96	81600
Skilled labour	700	1632	1442400
26,15,200			

Above table describes that resources required for completing a schedule of G+ 5 prefabrication methods. Here total cost observed to be 26,15,200Rs. This cost to be find out by calculating how resources to be allocated to each activity for particular duration.

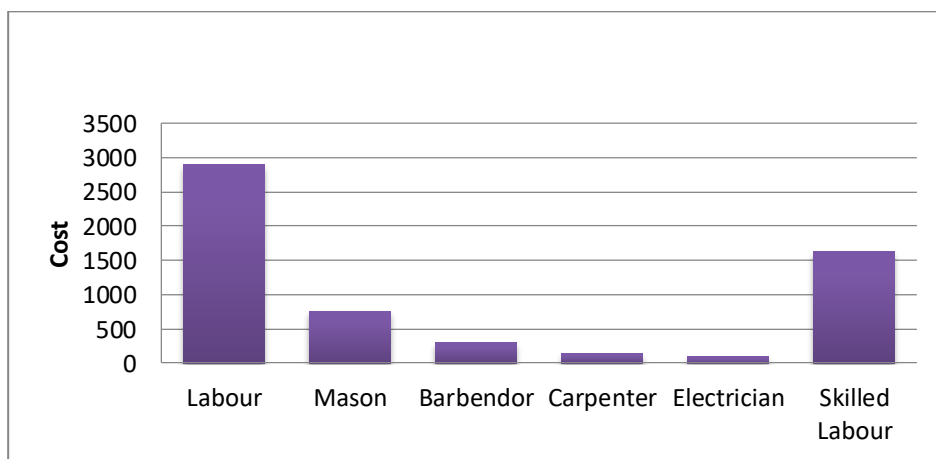


Figure 3: Resources Chart for Prefabrication Construction Method

Comparison of Resources for Conventional & Prefabrication Construction Method

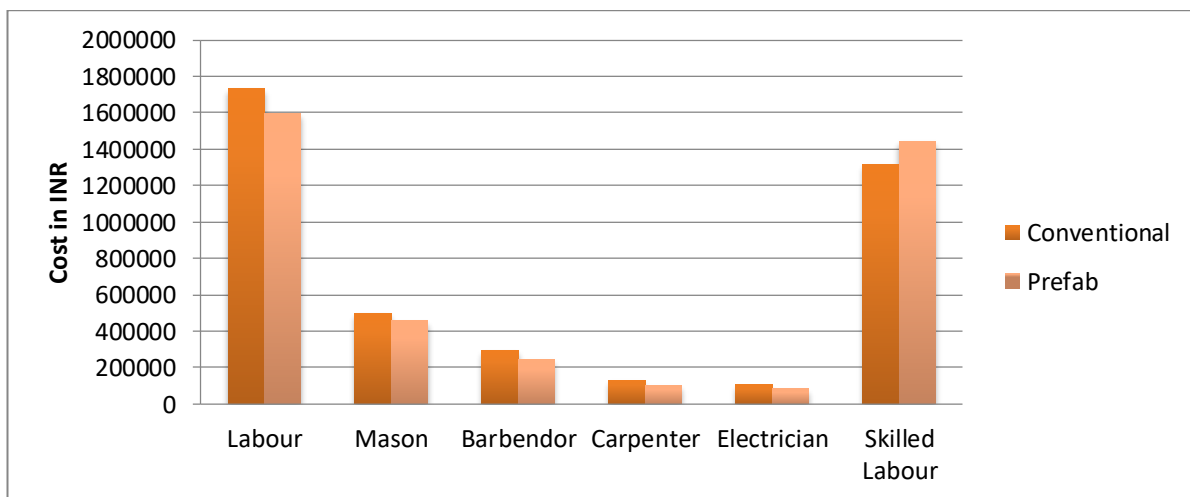


Figure 4: Comparison of cost using prefab and conventional method

V. CONCLUSIONS

The duration of prefab construction and conventional method construction is found by preparing MS project schedule with the help of the data inputs from the respective companies. The duration of structure work is taking into the consideration. From this study it is found that a considerable amount of money will be saved by using prefab



construction method. Precast beams, columns, slabs are manufactured in precast yard and can be installed at site, which reduces the time and human resources considerably.

The following conclusion can be drawn from the study:-

1. Indirect saving in cost due to reduction in man-days for the completion of structure work is approximately 30%.
2. The prefab construction takes less time in finishing work as electrical conduits and fittings are already installed in precast slab and wall panels.

Savings in plastering cost and time can be considered because finishing of prefabricated components are better than in-situ components.

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