Impact of Prefabrication Technology and Equipment On Profitability

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Abstract: Prefabrication is a manufacture and preassembly of components, elements or modules before installation into their final location. The prefab industry is the backbone for the development of new ideas in construction business of any country. In present scenario there is a large need for housing. So it has to be completed at some faster rate without affecting the cost. But with the conventional construction the speed cannot be achieved. So we opt for some other methods of construction. Precast construction is one of the method by which the total time of construction can be minimized. Precast construction has its own advantages such as it reduces the construction time; the erection is easy etc. but still in countries like India there is a hesitation to accept the precast technology. Prefabricated components are increasingly becoming an eminently improving technology to achieve cost effective and speedy construction in the construction industry. This increasing trend for prefabricated components has now turned into numerous applications as they can provide a much faster output for the ever increasing urban construction demand. In addition to this, adopting prefabrication technology also promoted mechanization in the construction industry and created new areas of employment. The study emphasizes the effect of prefabrication technology on the profitability and its effect in the construction work cycle.

Keywords: Deshuttering, Precast, Sustainability.

1. Introduction

Prefabrication is the Practice of assembling components of a structure in a factory or other manufacturing site and transporting complete assemblies to the construction site where the structure is to be located. The practice of prefabrication is popular in foreign countries and the interest in prefabrication in India has been increasing in recent years, India still shows reluctance towards this adoption. But it is gradually being adopted by a lot of developers, builders and contractors because of obvious advantage. At present precast concrete buildings are the advanced construction techniques available over worldwide. Being its wide applicability, the total precast concrete buildings systems are becoming a popular choice for many construction. Precast concrete available in many shape, sizes, including structural elements and unreinforced pieces. The prefab industry is the backbone for the development of new ideas in construction business of any country; Factory buildings, residential buildings and the industrial township are needed practically by all the sectors, either to support the manufacturing or services of any industry.

2. Comparison between precast and conventional construction

A. Conventional technology

The speed of construction is much slower due to step by step completion of different stages of the activities such as erection of formwork, concreting and deshuttering and thereafter plastering and other finishing activities. In this system the wall and the floors are casted simultaneously in one continuous operation and also the finishing work can be started immediately, so the speed of the construction is much faster.

B. Precast technology

The concept of precast also known as prefabricated construction includes those buildings where the majority of structural components are standardized and produced in plants in a location away from the building, and then transported to the site for assembly. These components are manufactured by industrial methods based on mass production in order to build a large number of buildings in a short time at low cost. The main features of this construction process are as follows:

- The division and specialization of the human workforce.
- The use of tools, machinery, and other equipment, usually automated, in the production of standard, interchangeable parts and products.

This type of construction requires a restructuring of the entire conventional construction process to enable interaction between the design phase and production planning in order to improve and speed up the construction. One of the key premises for achieving that objective is to design buildings with a regular configuration in plan and elevation.

Siva Priya et al., (May 2016) carried out this research as the construction industry replacing its method of implementing conventional methodology by various new innovations in the process of construction and selection of materials. This method of construction can increase productivity and quality of work through the use of better construction machinery, equipment, materials, and extensive pre-project planning. This study is essential since there is no organised body. In this research thesis the precast construction and conventional method is compared and it is found that the overall cost required for constructing the building using precast concrete method is reduced by 20%.
when compared to conventional method.

P. Karthigai Priya et al. (2018) carried out a comparative study on precast construction and conventional construction. In this study two main factors are considered for the comparative study. They are time and cost. In any construction project time and cost are the most important factors that have to be given more importance. If any delay occurs in the project these are the factors that get affected directly. After comparison it is found that the cost of precast construction is 1.4% higher than that of the conventional construction. The precast construction can be completed at a rate of 15.17% earlier than the conventional construction.

Dinoj K. Tony et al. (2018) carried out a detailed study on prefabrication technique in construction and its barriers. Prefabrication definitely has advantages over conventional technology in construction, but it has not really been able to compete with the conventional forms of construction. The main advantage of prefabrication is saves construction time, reduces construction waste, together with increased quality. The main barriers obtained from the survey were improper transportation facilities, logistical limitations to design and also prefabrication is more expensive than traditional construction method. This is because our society is mainly focused on cost effective construction and the fact that „time is money” has little weight in less developed areas.

3. Cost and Duration Comparison

As the population continuously growing rapidly, so the need of rapid or fast construction is requirement of future generation. Precast concrete construction methods are become feasible and alternatives method or solution in such applications Ides buildings and bridges. The primary benefit of precast construction is reduction in time of construction. Waste management and cost efficient construction. Precast concrete is the ideal solution for residential because the structure of residential buildings is somewhat standard so the construction of same type of elements are easy and result in to cost saving on if its production is in bulk. Precast concrete provides stability, Flexibility, sound durable and adaptability with cost efficiency. Precast concrete construction required less construction process which saws money on financing costs. Cost minimization on labor policies, skills, development of employ, providing training to them is main factors. Repairs cost also reduces in precast concrete construction. The following table shows the comparison of precast & cast in situ on basis of duration. Chetan Kumar B. (2015) carried out the comparison of cost indicates that the precast construction cost is 32% more than the conventional method. Also the time required for the conventional construction (1755 days) is much more than the precast method (1454 days). Regression analysis gives comparative results between the construction methods and the equipment’s used.

Dinesh Kumar et al., (April 2015) conducted a research so as to study the present situation of the precast construction industry in India. In his study two main factors are considered which are cost and time. 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. The comparison showed there is enormous cost difference between the methods, which the prefab is very high when compared to conventional on this type of individual houses. The prefab construction for individual double storey residential building cost is 13% more than the conventional construction. This is main drawback for prefab construction which is not economical to construct in this case. At the same time the prefab construction is easy to work and reduces the project duration, is reduced by 63 days when compared to the conventional

Akash Lanke et al., (June 2016) carried out a thesis to analyze the design, cost and time of precast and RCC buildings. Apart from these factors various other minor factors such as speed of construction, quality control, environmental conditions, labor resources, durability, connection, size, shape etc. are also considered for the analysis. The cost and duration are compared as major factors.

Evanjeline Libie (2016) carried out a study and concluded that precast concrete construction, besides the improvement of a building’s sustainable performance, include shortened construction time; overall reduced costs; enhanced quality and durability; improved health and safety, conservation of materials and energy; waste reduction; and finally reduced environmental emissions.

Rinkesh Patel et al. carried out a study on prefabrication technique and determined the total cost and total duration of double storey residential building for both prefab and conventional construction. The comparison showed there is enormous cost difference between the methods, which the prefab is very high when compared to conventional on this type of individual houses. The main advantages for prefab construction and also it helps when there is labour shortage.

4. Advantages of prefabrication technology

Prefabrication Technology has following major advantages.

1. Overhauling the view with energy efficiency: In the beginning prefabricated structure was considered to possess having low quality. In order to stand out from the fierce construction market, builders are looking to augment energy efficiency through various methods such as recycling materials, using LED lighting and installing solar panels to harness solar energy. This ensures saving of money on the energy utilization to the point where one may be producing clean energy that will be put back into the energy grid which helps in reducing the impact on the environment.

2. Minimal wastage and inspection struggle: The individual units are cast, cured and then transported to site and assembled using various erection machineries. As compared to structures built by using traditional method, prefabricated buildings produce minimum waste as all the required materials for
construction arrive on site in preassembled condition. In addition to the simplicity of construction and energy advantages, prefabricated structures are always manufactured in accordance to the specific design codes so that there are no problems when the structure is being inspected by concerned government authorities.

3. Dependable construction plan: There are very few chances of deviations to occur in the time schedule because the casting of the individual units being carried out in a controlled environment that cannot be affected by climate causing delays. Due to absence of such interruptions, the average structure would be constructed in shortest possible time. During this construction process, workers are put in a low risk environment that elevates their feelings of safety and comfort. Due to all these factors it is certain that the structure will get all necessary care and attention to the details that it requires in order to be built correctly.

4. Pace of work: The off-site fabrication process may take place in the warehouse, in parallel to activities carried out on site. This may reduce the overall construction time of a project by a considerable and significant amount.

5. Security: Health and safety are easier to control in a warehouse as most of the work may be carried out at waist height and skilled labours know the process, machinery and systems of the warehouse.

6. Sustainability: Minimum site disturbances, carefully managed flow of material and construction waste, and pre-planned assembly and disassembly can reduce the environmental impact that occur due to construction activities.

7. Quality: A clearly defined quality may be achieved in an isolated and controlled process, and the indoor environment means buildings and components are protected from climate changes.

Due to the numerous advantages mentioned above the prefabrication technology has an increasing demand in urban construction.

5. Limitations of prefabrication technology

Prefabrication technology is known to have the following limitations.

Restricted options in design: The availability of variety in the design depends on the firm or organization chosen to build the prefabricated structure with – one may be stuck with a limited amount of material options and possibilities of the layout. This implies that there are chances the structure may have less flexibility in the design than assumed or expected.

Decreased resell value: Majority of the people think they are of poor quality and low strength, which makes them extremely difficult to resell.

High initial investment: The adoption of prefabrication technology demands a high amount of initial investment.

Non-suitability for substructure: The prefabrication technology cannot be used in the construction of substructure. The construction of foundation and plinth is done by the conventional method and then the construction of superstructure is done by using prefabrication technology.

Transportation of precast units: Transportation can turn out to be expensive for construction of prefabricated structures. The actual transportation cost inculcated is based on numerous paramount factors such as transport distance, permit cost, and trailers expectations.

Manufacturers of prefabricated components usually prefer ship their elements by truck and trailer to the construction site. According to the nature of the prefabricated system adopted and location of the site, certain complications can arise during transporting the precast elements.

Increases in miscellaneous risks: Several unanticipated risks are associated with prefabrication technique in comparison to the traditional construction method. This is due to the reason that the majority of the large building elements are constructed off-site; a huge amount of trust and responsibility is placed on the manufacturer to produce exactly what are as per specified requirements so even minor errors and discrepancies may put the entire structure in danger.

6. Conclusion

From the study of several research papers it is concluded that prefabrication is a manufacturing process; generally taking place at a specialized facility, in which various materials are joined to form a component part of the final installation. The main advantage of prefabrication is saves construction time, reduces construction waste, together with increased quality. It is remarkably seen that the cost of building constructed using prefab technology is significantly less and duration of construction is also much lesser as compared to traditional method. The prefab construction method helps in reducing the adverse impacts on the environment and offers an environmental friendly construction. Hence, prefab construction technique is much more efficient and sustainable. The better quality control may be achieved if this technology is adopted for repetitive type of works. From the study one may conclude that the prefab technology is economical. The sustainability aspects viz. social, economic and environmental may promote prefab technology as a promising alternative in construction industry.

References

