ISSN 2395-1621



Impact of Prefabrication Technology on Profitability using Concrewall Panel System

Poonam Prakash Bhalgat, Prof. Rahul D. Shinde, Prof. Swati B. Kshirsagar

DEPARTMENT OF CIVIL ENGINEERING

RMD SINHGAD SCHOOL OF ENGINEERING, WARJE, PUNE-58

ABSTRACT

ARTICLE INFO

Prefabrication has been widely regarded as a sustainable construction method in terms of its impact on environmental protection. One important aspect of this perspective is the influence of prefabrication on construction waste reduction and the subsequent waste handling activities, including waste sorting, reuse, recycle, and disposal. Nevertheless, 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; integrating all essential waste handling activities has never been achieved thus far. This Topic proposes a dynamic model for quantitatively evaluating the possible impacts arising from the application of prefabrication technology on construction waste reduction and the subsequent waste handling activities. The object of this project is to identify new technologies or methodologies in the Construction Industry that could require new training or up-skilling of the trades and semi-skilled workforce.

Keywords: Prefabrication Technology, Concrewall Panel System

I. INTRODUCTION

Prefabrication has brought a substantial change in the development of construction industry worldwide over the last few decades. It ensures the strength, economy and environmental performance of the structures and hence is preferred over the onsite construction. Pre-assembly, prefabrication, modularization, system buildings and industrialized buildings are the various terms used to describe the processes of manufacturing of modular units on-site or off-site. Prefabrication usage large panel technology was initially developed in the mid 1960s. This is quick construction of huge numbers of building units at a minimal cost. It is referred as off-site construction and fabricating of some or all elements of structure in industrial units, and transporting and assembling them to the construction site where the building is to be made. It is learnt that this construction technique exists from prehistoric times and has not been evolved recently. "The Stonehenge" is a prominent example as it was also completed in different stages.

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 role of prefabrication in architecture has been lauded for its Article History Received: 30th May 2022 Received in revised form : 30th May 2022 Accepted: 2nd June 2022 Published online : 2nd June 2022

potential to increase productivity and efficiency while not sacrificing quality. The values of better, faster and cheaper are applicable to developed countries such as the U.S., Japan, and Europe, whose middle class continues to demand this equation in buildings that range from the remarkable to the prosaic. Developing countries, including China, India, Africa and many parts of South America, that are beginning to rely on prefabrication have the potential advantages of realizing housing quickly and affordably; however, greater reliance on manufactured production has possibly more disadvantages than advantages for these cultures. With prefabrication, improved working conditions would seem to be agreeable to everyone: instead of building in the weather, international fabricators supply controlled environments with ergonomically considered equipment and yet in many fabrication environments, reliance on minimal skills, and a disconnect with the community in which workers live, leaves little room for continued fostering of personal and collaborative skills, culture, tradition and community building.

1.1 Necessity of Prefabrication in Construction Industry

Prefabrication is one of the key elements of industrialization in construction. Prefabricated construction methods are presenting a range of techniques to improve the building www.ierjournal.org

construction, quality and how to reduce the negative impact of building production on the environment. Prefabrication is a modern construction technique that is growing in popularity. Prefabrication enables time and cost savings, quality control, and an eco-friendly construction process.

Prefabricated sections are cast and cured in large quantity at the factory site and then transported to various construction sites. This procedure works in any poor weather conditions and also reduces time and material wastage at the site. This technique allows the erection of structures in less time.

The impact on cost is the most controversial topic in the prefabrication literature, as prefabrication has been shown to be more cost-efficient than on-site construction due to reduced labor and material costs and less construction waste highlighted 30% savings from off-site construction; however, prefabrication implementation also increases capital costs through investments in new machinery and factories. Costs are also increased due to additional transportation costs, complex techniques, and the requirement for highly skilled workers.

1.2 Problems of the Construction Industry

The subject of construction as an environmentally unfriendly activity has become arguably redundant. The level of pollution generated by construction alone is overwhelming and has been worsened globally due to the rapid rate of urban development. The challenges faced by and imposed by the construction industry on the environment and human life have been identified as construction waste, GHG and carbon emissions, high energy and resource consumption rates, and the lack of technological advancement in the face of the fast-paced movement of other industrial sectors.

II. PROBLEM STATEMENT

In Conventional Approach, the Subject of Construction as an environmentally unfriendly activity has become arguably redundant. The level of Pollution generated by construction alone is overwhelming and has been worsened globally due to the rapid rate of urban development also lacking in dynamic nature for quantitively evaluating the possible impacts arising from the application of prefabrication technology on construction waste reduction. New technologies or methodologies in the construction are completely absent.

III. OBJECTIVES

- To Study new Technology used in Prefabrication Technology to complete the project.
- To compare the time and cost incurred when constructing a Residential building using expanded polystyrene panels and conventional (traditional) method using RC moment frame with brick infill.
- To develop an approach that enables use of discrete event simulation in scheduling of construction operations i.e. simulation based scheduling.

IV. LITERATURE REVIEW

[1] Wajiha Shahzad, Jasper Mbachu, and Niluka Domingo. ,Prefab content versus cost and time savings in Construction projects

Using a case study research approach, 30 light to medium commercial buildings completed New Zealand, were investigated. The project details acquired included initial cost estimate, final completion cost, estimated duration, actual duration, gross floor area and the value of prefab content as percentage of the final contract sum.

[2] Chantelle Grills.,Industrialization of the Construction Industry through Prefabrication and Adoption of Current Technologies

In this project, it is performed in a factory, allowing for the use of automated equipment to reduce labour and full-time factory employees ensure that project delays due to the unavailability of skilled tradespeople are avoided. Improved product quality is achieved through highly sophisticated equipment, better supervision, and climatic protection.

[3] The Impact of New Technologies on the Construction Industry By Construction Training Fund, U.K May 2014

There is no single system of building construction classification (as opinionated by Warswaski, 1999). The author believed that such a classification was relative to the user/producer and varied from one to another, usually based on the choice of construction technology. Based on this, it was asserted that four systems could be distinguished as determined by the main structural and enveloping materials of the building: timber, steel, cast in-situ concrete, and precast concrete systems. Warswaski (1999) also suggested that for further classification, the geometric configuration of the components of the building's mainframe could be used as follows: linear or skeletal system (beams and columns); planar panel) system; and three-dimensional.

[4] By Majzub, Prefabrication and Modularization in Construction, 2013 Survey Results

Industrialization of the Construction Industry through Prefabrication and Adoption of Current Technologies. By On the other hand, three building classifications are proffered by Kok primarily based on their methods of construction: conventional, cast in-situ, and prefabrication construction methods. Furthermore, whereas Abdul Kadir et al. subcategorised prefabrication and cast in-situ under IBS, Kok sub-lists IBS as a prefabrication method. Kok then defines CBS as the on-site prefabrication of a building's components using the methods of installation of timber or plywood formwork, steel reinforcement and in-situ casting. Cast in-situ construction method involves on-site implementation of formwork, a method that can be retrofitted for all types of building construction. Prefabrication method is defined as the process of manufacturing industrialized or precast construction components, offsite (in a factory), before delivery for erected on the actual construction site.

www.ierjournal.org

[5] Amanda Marquit, A History of Prefabricated and Modular Housing Commissioner Robert D. LiMandrin carrying out the literature review, a note-worthy conflict in the classification of prefabrication was observed. Several definitions of prefabrication are clearly in favour of a system that consists entirely of offsite (factory-based) production of its components. However, Abdul Kadir et al. (2006) state that a fully prefabricated system could be one of two categories depending on the site of production: on-site or off-site (factory-produced). They argue that on- site prefabrication differs from the cast in-situ method. Here, the on-site system means that structural building components are cast in the site before being erected at the actual location. In their opinion, the on-site system also provides more advantage over the cast in-situ method.

[6] By Wajiha Shahzad, Jasper Mbachu, and Niluka Domingo, Prefab content versus cost and time savings in Construction projects: a regression analysis

Meeting the construction needs requires the utilization of large amounts of energy and natural resources The construction industry consumes 60% of the earth's extracted raw materials, of which buildings consume 40%, hence it is referred to as the '40% Industry'. Apart from basic construction processes, the manufacture and transportation of building materials is a significant consumer of energy. The United States Green Building Council (2003) data on the resource consumption levels of buildings in the United States shows 37% for total energy, 68% in electricity.

[7] Bindurani.P, A. Meher Prasad, Amlan K. Sengupta Assistant Professor, Dept. of Civil Engineering RIT, Kottayam, Kerala, India Professor, Dept. of Civil Engineering IIT Madras, India Associate Professor, Dept. of Civil Engineering IITMadras, India

Precast concrete systems represent an efficient alternative for building construction. The behaviour of a precast system depends on connections and it should be modelled properly in the computational models for analysis and design. This study presents the modelling of connections in a wall type precast building system. A case study on a 23-storeyed building, made up of precast wall panels and slabs, to study the modelling of vertical joints in terms of shear transfer, is presented in the paper.

[8] Nitesh j Ramchandani Prof. Hemant Salunkhe M.E.Student (Construction & Management), Department of Civil Engineering D. Y. Patil Institute of Engineering & Technology, Ambi Pune, To Study Impact Of Prefabrication On Profitability Over Traditional Construction- A Review Prefabrication helps in terms of its impact on environmental protection and widely regarded as a sustainable construction method. The goal of prefabrication is to offer a way to get a well-designed building that is at least roughly tailored to resident needs. It could be stated that prefabrication system in building construction have the most effect on time and cost. One important aspect of this is the influence of prefabrication on construction waste reduction and waste handling activities including waste sorting, reuse, recycle, disposal. In recent research this topic has failed to take in to account its character of the process of construction waste minimization; integrating all essential waste handling activities has never being achieved. This topic helps to propose the possible impact arising from the application of prefabrication technology on construction waste reduction and the subsequent waste handling activity. Prefabricated building and structure are mounted from uniform prefabricated three-dimensional units, providing strength, pre-set thermal properties of structures, dynamic stability, immutability of geometric dimension of prefabricated elements during their manufacture, transportation and installation in special and difficult conditions.

[9] Shubham D. Auti1, Dr. Jalindar R. Patil, Prefabrication Technology - A Promising Alternative in Construction Industry, Savitribai Phule Pune University, Dr. D. Y. Patil Institute of Technology, Pimpri, Pune, 411018, Maharashtra, India

The construction industry is growing exponentially day by day and it makes a remarkable contribution in escalating the pace of development of the nation. Refinements are adapted and analyzed at each and every stage of construction. The reason of assessing all these refinements is to enhance the overall ease and feasibility of the work cycle. These refinements also make a significant change in the total cost of the project. 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

[10] N. Dineshkumar, Comparative study on prefabrication construction with cast in-situ construction of residential buildings

He conducted a comparative study on prefabrication construction with cast in-situ construction of residential buildings. The construction boom in India is developing at a fast rate of growth. It provides wide opportunity in India for a new entrant in prefab sector. At present precast concrete buildings are the advanced construction techniques available over worldwide. 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.

V. CONCREWALL PANEL SYSTEM

Description of System Name of the System– Concrewall System Brand Name – Concrewall

Brief Description

www.ierjournal.org

The Concrewall System is an industrial system for the construction of structural walls of reinforced concrete for building in single panel up to G+3.

The system is composed of a factory produced panel of undulated (wave shape) polystyrene covered on both sides by an electro-welded zinc coated square mesh of galvanized steel and linked by 40 connectors per sq m made of highelastic-limit 3mm dia wires realizing a 3 dimensional hyperstatic reinforced steel.

The panels are assembled on site and in-situ concrete (double panels, floors, stairs) and concreted concrete poured (single panel) to realize the following different elements of the system: Vertical structural walls Horizontal structural elements Cladding element, internal walls.



VI. CONCLUSION

Evidence From Several Studies Showed that Precast Concrete Construction, Besides the improvement of A Building's Sustainable Performance, Include

- Shortened Construction Time
- Overall Reduced Costs
- Enhanced Quality
- Durability,
- Improved Health
- Safety,
- Conservation Of Materials And Energy
- Waste Reduction
- Finally Reduced Environmental Emissions.

VII.REFERENCES

[1] Concrewall building system-The innovative Concrewall building [M2] system,www.cbs-ibs.com.

[2] Rohit Raj, Manoj Kumar Nayak, Md Asif Akbari and P. Saha, Prospects of Expanded Polystyrene Sheet as Green Building Material, International Journal of Civil Engineering Research 5(2) 2014.

[3] Marvin E.Mundel, David L. Danner, Motion and Time study improving productivity, Prentice Hall India, 1948.

[4] Government of India, CPWD (2013), Analysis of Rates for Delhi, Volume1.

[5] C.Freeda Christy, R.Mercy Shanthi, D.Tensing, Bond Strength of The Brick Masonry. International Journal of Civil Engineering and Technology, 3(2), 2012, pp.380–386.

[6] Ghassan Subhi Jameel, Study The Effect of Addition of Wast Plastic On Compressive and Tensile Strengths of Structural Lightweight Concrete Containing Broken Bricks As Acoarse Aggregate. International Journal of Civil Engineering and Technology, 4(2), 2013, pp.415–432.

[7] Brian Jacks Odero, R. N. Mutuku and C. K. Kabubo, Mechanical Characteristics of Normal Concrete Partially Replaced with Crushed Clay Bricks. International Journal of Civil Engineering and Technology, 6(1), 2015, pp.62–75.