

Evaluation of Prefabrication Technologies in Construction

Alireza Baghchesaraei,

Young Researchers and Elite Club, Parand Branch, Islamic Azad University, Parand, Iran
Corresponding author email: alireza@baghchesaraei.com

Omid Reza Baghchesaraei

Young Researchers and Elite Club, Parand Branch, Islamic Azad University, Parand, Iran

ABSTRACT — There are various technologies available worldwide for using prefabricated construction methods, almost all technologies try to reduce costs and time, prefabrication method gives possibility to the designers for assembling their structures in a short period of time. There are numerous potential advantages related when delivering and developing building by prefabrication. The accompanying segments have been separated under two headings keeping in mind the end goal to intelligently introduce these thoughts. This research would try to present an appropriate classification of prefabrication technologies and link them to present construction market to discover the differences between developed and developing countries by coordinating relevant data and information comes from valid sources. Nowadays, different systems of prefabrication are utilized in both developed and developing countries, however the usage of systems is not the same. Most of developing countries do not have any specific model for their prefabrication construction. They prefer to utilize types and methods which can be perform and execute with accessible materials. Prefabrication technologies could be used more in building construction if the disadvantages of prefabrication are removed and more suitable way are detected to find an appropriate relationship with prefabrication techniques with priorities like sustainability, project management and seismology.

KEY WORDS: Prefabrication, Technologies, advantages, Construction

Introduction

Conventional building systems, for example, block, solid, steel and prefab consent just halfway with these necessities. The Conventional system for constructing a building in prefabrication is to transport structural elements and structural materials and so forth to the site, and to construct the building on site. In prefabricated construction, only the establishments are developed thusly, while segments of dividers, floors and rooftop are assembled in a processing factory (conceivably with window and door jams included), transported to the site, lifted into spot by a crane and blasted together. There are various technologies available worldwide for using prefabricated construction methods, almost all technologies try to reduce costs and time, prefabrication method gives possibility to the designers for assembling their structures in a short period of time. There are two techniques for people to get a new way for construction. One way is to use traditional ways that offers a handful of models and the other way, for those with a strong desire for customization, are to design a system from scratch, and have it built from basic components.

The goal of prefabrication is to offer a third way, a way to get a well-designed building that is at least roughly tailored to resident's needs. There are numerous potential advantages related when delivering and developing building by prefabrication. The accompanying segments have been separated under two headings keeping in mind the end goal to intelligently introduce these thoughts [1]. The construction assembly advantages components will basically consider upgrades connected with the real gathering of prefab frameworks, though the assembling advantages area will look at the preferences emerging from the generation of these frameworks in a controlled manufacturing factory setting. The work with this paper was initiated with a general literature study to get an overview of construction methodologies of prefabrication technologies to acquire some background knowledge of these kinds of constructions. The aim of this research is to examine various prefabrication technologies according to their structural elements and find the differences between developed and developing countries.

Methodology

The work with this paper was initiated with a general literature study to get an overview of construction methodologies of prefabrication technologies. To acquire some background knowledge of these kinds of constructions the first step was to look into how prefabrication systems have been constructed historically. The focus of the article was to study the different methods that are used today when constructing prefabricated buildings. This was done to get a good background knowledge of construction of prefabricated buildings. The research explores the advantages and disadvantages of prefabrication systems and

investigating the relationship between prefabrication and construction future. The survey connects an empirical observation to practical process, suggesting prefabrication ideas or solutions concerning how people could use prefabrication as a suitable method in future. Collecting relevant data was very important and it is done by field work, observation and also desk work to obtain different information from different valid sources. This research would try to present an appropriate classification of prefabrication technologies and link them to present construction market to discover the differences between developed and developing countries by coordinating relevant data and information comes from valid sources.

Prefabrication technologies in developed and developing countries

Prefabricated construction has been a typical development strategy in developed countries for over a century. The idea of "assemble it quick" in the most conservative way has not changed subsequent to the starting; on the other hand, new frameworks have been created to suit the advanced world pre-assembled development. Construction frameworks are not just helping foremen and proprietors get their structures speedier and all the more monetarily however they additionally help decrease construction waste and create high vitality effectiveness structures which bring a long haul advantage to extend [2]. Prefabrication for building construction has been utilized in developing countries for just last two decades, yet it has been developing quickly in the previous five years. As of late, there have been numerous new designers, and builders who have changed from customary construction to prefabrication. Designers in developing countries see prefabrication as the future and are prepared to put more in this kind of construction [3]. Although, prefabrication systems are a typical technique for construction in developed countries, several developing countries are still not acquainted with those frameworks. Since developing countries have diverse social and monetary frameworks from the developed countries they have a tendency to utilize more genuine labor for prefabricated construction as opposed to modernized prefabrication systems [4]. Nowadays, different systems of prefabrication are utilized in both developed and developing countries, however the usage of systems is not the same [5]. In developed countries panel systems are the most common used construction system in prefabricated buildings. For example, 43 percent of all prefabricated homes and 68 percent of all prefabricated buildings in the USA use the panel system [6]. Curtain wall system mostly is used for facades of the buildings in developed countries especially for facades with glass components especially in medical and commercial buildings (Figure 1). Structural insulated panels mostly used for producing sound and fire insulations there and Large-panel system is mostly used for residential zone constructions [7].



Figure 1. The prefabricated building

Frame systems are the widely used system for tower constructions in developing countries, since the frame system especially the steel frame system is an appropriate option for complicated structures [4]. Steel frames system give the chance to designers to predict every obstacles of the project before the beginning of the construction process and they have systematic computation, in the other hand the steel frame system is stronger enough to resist against earth quakes, so 52 percent of all towers in japan use the steel frame systems [4]. Wood frame systems mostly are used in small projects in developed countries especially platform wood frame system. Timber and wood are easy access materials in many developed countries and the fast execution of the projects is the main advantage for using the platform wood frame system there [7] (Figure 2).



Figure 2. Prefabricated wood frame building

Cells system is widely used in countries with specific climate conditions, since producing components in diverse and hard climate is hard and cells system is an appropriate system for producing them in factories under favorable positions. At present, enormous prefabrication construction showcases in developed countries are in progress and prefabrication construction has shown its potential in development process there [8]. Prefabricated construction in most of developing countries especially in eastern Asian ones such as: Philippine, Thailand and Vietnam are in view of area in preparing plants and after that sent to their ceaseless region. The way that these structures can be inborn separate parts, makes them less requesting to gather and transport. Perhaps, it is the pace of improvement, simplicity, versatility of design and environment welcoming structure, which is the principle catalyst behind present solicitations. In spite of the fact that construction has been utilized for development as a part of developing countries for over a quarter century, was not exceptionally well known until the previous five years [9]. Unfortunately in many developing countries the shortage of expertise does not allow them to use prefabrication in its best way, since the industrialization rate is not in suitable rate and without appropriate factories prefabrication construction cannot work properly [1]. Most of developing countries do not have any specific model for their prefabrication construction. They prefer to utilize types and methods which can be perform and execute with accessible materials. So, wood framing is one on the most popular types in developing countries particularly in eastern Asian countries where their climate is suitable for wood usage and it is accessible; however unlike the developed countries Balloon wood frame system because of its easier execution is used in developing countries [1]. One of the upscale particular item that is at present accessible on the prefabrication construction system is the steel frame system, however the steel frame system is very expensive and its computation needs enough knowledge is not that much usual like developed countries, and in the other hand because of the lack of experience they mostly cannot predict the project obstacles (figure 3) [1].



Figure 3. Steel frame system in Iran

Some small builders in developing countries have come up with a very cheap way to build prefabricated buildings. This prefabricated system is known as a knock-down system which is affordable small-size building that is either assembled from the factory before being transported to a site or factory-prefabricated building components that are transported to a site before being assembled (Figure 4) [6].



Figure 4. A knock-down building

A knock-down building is constructed from modest materials, for example, wood or metal studs with cellulose-concrete board. Many designers define this system as impermanent natural surroundings in the greenhouse or a little coffeehouse; notwithstanding, this system is additionally utilized as a perpetual building for low-pay individuals. In any case, these sorts of buildings do not have a construction standard to control them, so the vast majority of them are casual buildings. There is no insurance on the quality of this item [8].

Conclusion

Manufacturers would present prefabrication techniques with a blend of off-site and on-site advances. In parallel to this organizations, can move toward more institutionalization with quite lessened outline portfolios. This implies engineers might be included at an opportune time, and that customers need to finish all progressions before production starts [10]. This includes early association of customer, architects and engineers. In any case, different partners, for example, moneylenders, back up plans, arranging and building control powers require more inclusion. There is contradiction about which advancements matter most, and how prefabrication effects can be measured when there is no concurred criteria to survey execution past expenses. The

advantages of time, quality, wellbeing and security, and sustainability are frequently concealed and not completely acknowledged. Advancement of trials is expected to better comprehend these advantages. Training is important since in spite of general conviction, Prefabrication techniques won't fundamentally adjust for shortage of skills. A comprehension of the methods and exactness included in prefabrication is fundamental. There is a need to prepare staff on the more drawn out term advantages of prefabrication and to lessen staff turnover by elevating a comprehensive way to deal with construction. It is understood that, prefabrication technologies could be used more in building construction if the disadvantages of prefabrication are removed and more suitable way are detected to find an appropriate relationship with prefabrication techniques with priorities like sustainability, project management and seismology (particularly in developing countries and countries in seismic zones), these could be done by architects, engineers, producers and even by clients.

References

1. Rippon, J. A. (2011). The benefits and limitations of prefabricated home manufacturing in North America. California University. USA.
2. Harris, F., Mc Caffer, R. (2001). Modern Construction Management, Blackwell Science, 5th Edition, London.
3. Koskela, L., Howell, G., Ballard, G., and Tommelein, I. (2002). "The Foundations of Lean Construction." Elsevier, Oxford, UK.
4. Barlow, J., et al., (2003). Choice and delivery in housebuilding: lessons from Japan for UK housebuilders. Building Research & Information.
5. Baghchesaraei, A., Vatan, M., and Baghchesaraei, O.R. (2015). Using Prefabrication Systems in Building Construction. International Journal of Applied Engineering Research. Volume 10, Number 24, 44258-44262.
6. Smith, Ryan E. (2010). Prefab Architecture: A Guide to Modular Design and Construction. Wiley, Hoboken: NJ. USA.
7. Naaman, A. (2004). Prestressed Concrete Analysis and design. Blackwell Science, London.
8. Kim, T. (2009). Comparison of prefab homes and a site-built home: Quantitative evaluation of four different types of prefab homes and a site-built home. Southern California University. USA.
9. Reddy, A. (1996). A Macro Perspective on Technology Transfer. Quorum Books.
10. Baghchesaraei, A., & Baghchesaraei, O. R. (2014). The Importance of Infrastructures in the Development of Modern Methods of Construction. International Journal of Applied Engineering Research. Volume 9, Number 21, 11689-11692.