

Industrialized building system essay sample



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1. 0) INTRODUCTION

The industrialized building system (IBS) can be generally interpreted as in which all building components such as floors, walls, columns, beams, and roofs are mass produced either in a factory or at site factory according to specifications with standardize shapes and dimensions and transported to the construction projects site to be assembled into a structure with minimal site wet work and erected on the site properly joined to form the final units. The development of industrialized building system (IBS) is not new in the construction industry.

The idea of industrialized building system (IBS) has received much attention in the devastated countries after the Second World War. Though, Malaysia did not suffer the impact of the war, the need to supply its population with affordable and quality houses has prompted the government to promote the use of IBS as an alternative to conventional building system.

2. 0) DEFINITION OF IBS

There are a few definitions by researchers and experts in this field which can be found through literature. Rahman and Omar (2006) defined IBS as a construction system that is built using pre-fabricated components. The manufacturing of the components is systematically done using machine, formworks and other forms of mechanical equipment. IBS is defined as products, systems and techniques used in making construction less labour - oriented, faster as well as quality controlled. It generally involves pre fabricated products, factory manufactured elements that transported to the construction sites and erected. (Shaari, Bulletin Ingénieur, 2003). According

to Abraham Warszawski (1999), IBS is defined as a set of element or component which is inter-related towards helping the implementation of construction works activities. He also expounded that an industrialisation process is an investment in equipment, facilities, and technology with the objective of maximising production output, minimising labour resource, and improving quality while a building system is defined as a set of interconnected element that joint together to enable the designated performance of a building.

Triksa (1999) defined IBS as a system in which concrete components prefabricated at site or in factory are assembly to form the structure with minimum in situ construction. Esa and Nuruddin (1998) asserted that IBS is a continuum beginning from utilizing craftsmen for every aspect of construction to a system that make use of manufacturing production in order to minimise resource wastage and enhance value for end users. Perhaps the most comprehensive definition of IBS was clarified by Junid (1986). He mentioned that IBS in the construction industry includes the industrialized process by which components of a building are conceived, planned, fabricated, transported and erected on site. The system includes a balanced combination between the software and hardware components. A construction technique in which components are manufactured in a controlled environment (on or off site), transported, positioned and assembled into a structure with minimal additional site works (CIDB, 2003a).

3. 0) TYPES OF IBS

Warszawski (1999) asserted that the building system could be classified in different ways, depending on the particular interest of their users or producers. Such classification uses construction technology as a basis for classifying different building systems. In this manner four major groups can be distinguished namely, system with (1) timber, (2) steel, (3) cast in situ concrete, and (4) precast concrete as their main structural and space enclosing materials. These systems can be further classified according to the geometrical configuration of their main framing components as follows (1) linear or skeleton (beams and columns) system, (2) planar or panel systems, and (3) three dimensional or box systems. According to Badir- Razali, generally, there are four types of building systems currently available in Malaysia's building system classification (Badir et al. 1998), namely conventional, cast in-situ, prefabricated and composite building systems. Each building system is represented by its respective construction method which is further characterised by its construction technology, functional and geometrical configuration.

1. Precast Concrete Framing, Panel and Box Systems

Precast columns, beams, slabs, 3-D components (balconies, staircases, toilets, lift chambers), permanent concrete formwork, etc;

Figure 1. 1 -Precast concrete wall

2. Steel Formwork Systems

Tunnel forms, beams and columns molding forms, permanent steel formworks (metal decks, etc;

Figure 1. 2 -Steel formwork system

3. Steel Framing Systems

Steel beams and columns, portal frames, roof trusses, etc;

Figure 1. 4 -Steel roof trusses

4. Prefabricated Timber Framing Systems

Timber frames, roof trusses, etc;

Figure 1. 5 -Prefabricated timber framing system for a double storey house.

5. Block Work Systems

Interlocking concrete masonry units (CMU), lightweight concrete blocks, etc.

Figure 1. 6 -Lightweight concrete blocks are used for wall construction

The pre-cast concrete components are among the most common prefabricated elements that are available both locally and abroad. The pre-cast concrete elements are concrete products that are manufactured and cured in a plant environment and then transported to a job site for installation. The elements are columns, beams, slabs, walls, 3-D elements (balconies, staircase, toilets, and lift chambers), permanent concrete formwork and etc. The steel formwork is prefabricated in the factory and then installed on site. However the steel reinforcement and services conduit are installed on site before the steel formwork are installed. The installation of this formwork is easy by using simple bracing system. Then concrete is poured into the formwork and after seven days, the formwork can be

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removed and there is some system where by the formwork served as a part of the structure itself after concreting. The steel formwork systems are used in tunnel forms, beams, column moulding forms and permanent steel formworks.

The elements of steel framing system are rolled into the specific sizes and then the elements are fabricated that involves cutting, drilling, shot blasting, welding and painting. Fabricated elements are sent to the construction site to be then erected whereby welding and the tightening of bolts at joints are conducted. The elements include steel beams and columns, portal frames and roof trusses. The prefabricated timber framing system is normally used in the conventional roof truss and timber frames. The timber is prefabricated by joining the members of the truss by using steel plate. It is important that all members are treated with the anti pest chemical. Then, the installation is done on site by connecting the prefabricated roof truss to the reinforcement of the roof beams. The elements of block work system include interlocking concrete masonry units(CMU) and lightweight concrete blocks.

4. 0) CHARACTERISTICS OF IBS

4. 1 Closed System

A closed system can be classified into two categories, namely production based on client's design and production based on pre-caster's design. The first category is designed to meet a spatial requirement of the client's, that is the spaces required for various functions in the building as well as the specific architectural design. In this instance, the client's needs are paramount and the pre-caster is always forced to produce a specific

component for a building. On the other hand, the production based on precaster's design includes designing and producing a uniform type of building or a group of building variants, which can be produced with a common assortments of component. Such building includes school, parking garage, gas station, low cost housing, etc.

Nevertheless these types of building arrangement can be justified economically only when the following circumstances are observed (Warszawski, 1999). a) The size of project is large enough to allow for distribution of design and production costs over the extra cost per component incur due to the specific design. b) The architectural design observes large repetitive element and standardisation. In respect to this, a novel prefabrication system can overcome the requirement of many standardised elements by automating the design and production process. c) There is a sufficient demand for a typical type of building such as school so that a mass production can be obtained.

4. 2 Open System

In view of the limitations inherent in the closed system, an open system which allows greater flexibility of design and maximum coordination between the designer and precaster has been proposed. This system is plausible because it allow the precaster to produce a limited number of elements with a predetermined range of product and at the same time maintaining architectural aesthetic value.

4. 3 Modular Coordination

Modular co-ordination is a coordinated unified system for dimensioning

spaces, components, fitting, etc, so that all elements fit together without cutting or extending even when the components and fittings are manufactured by different suppliers (Triksa, 1999).

The objectives of modular co-ordination are:

a) to create a basis upon which the variety of types and sizes of building components can be minimized. Through a rationalised method of construction, each component is designed to be interchangeable with other similar ones and hence, provide a maximum degree of freedom and choice offered to the designer. This can also be accomplished by adopting a relatively large basic measurement unit (basic module) and by limiting the dimensions of building components to a recommended preferred sizes (Warszawski, 1999). b) to allow for easy adoption of prefabricated components to any layout and for their interchangeability within the building. This is achieved by defining the location of each component in the building with reference to a common modular grid rather than with a reference to other components (Warszawski, 1999).

4. 4 Standardisation and Tolerances

For accomplishing the requirement of modular co-ordination, all components need to be standardised for production. Such standardisation of space and elements need prescribing tolerances at different construction stages such as manufactured tolerances, setting out tolerances, and erection tolerances, so that the combined tolerance obtained on statistical considerations is within the permitted limits (Triksa, 1999). Production resources can be used in the most efficient manner if the output is standardised. Then the

production process, machinery, and workers' training can be best absorbed to the particular characteristics of the product.

4. 5 Mass Production

The investment in equipment, human resources, and facilities associated with an industrialisation can be justified economically only when large production volume is observed. Such volume provides a distribution of the fixed investment charge over a large number of product units without unduly inflating their ultimate cost (CIDB Singapore, 1992).

4. 6 Specialisation

Large production output and standardisation of precast elements allow a high degree of labour specialisation with the production process. The process can be subdivided into a large number of small homogenous tasks. In such working condition, workers are exposed to their work repetitiously with higher productivity level (Warszawski, 1999).

4. 7 Good Organisation

High production volume, specialisation of work, and centralisation of production requires an efficient and experienced organisation capable of a high level of planning, organising, coordination and control function with respect to production and distribution of the products (Warszawski, 1999).

4. 8 Integration

In order to obtain an optimal result, a high degree of coordination must exist between various relevant parties such as designer, manufacturer, owner, and contractor. This is achieved through an integrated system in which all these functions are performed under a unified authority (Warszawski, 1999)

4. 9 Production Facility

The initial capital investment for setting up a permanent factor is relatively experience. Plant, equipment, skilled worker, management resources need to be acquired before production can be commenced. Such huge investment can only be breakeven if there is sufficiently demand for the products. On the other hand, a temporary casting yard or factory can be established at the project site in order to minimise the transportation costs (Peng, 1986).

4. 10 Transportation

It is found that casting of large-panel system can reduce labour cost up to 30 percent. However, these cost savings are partially offset by the transportation costs. The transportation of large panels is also subject to the country's road department requirement. These limitations must be taken into consideration when adopting a prefabrication system (Peng, 1986).

4. 11 Equipment at Site

For the purpose of erecting and assembling precast panels into their position, heavy crane is required especially for multi-storey building. It is therefore important to incorporate this additional cost when adopting a prefabrication system (warszawski, 1999).

5. 0) ADVANTAGES OF (IBS)

1- High quality and good acceptance

- High quality-controlled products due to controlled environment in factory, better material selection and using high mechanized technology.
- Skilled workers with specific scope of works improve efficiencies and reduce errors.

2- Cost

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- Reducing on-site workers significantly reducing labor cost for contractors.
 - Minimizing cost of transferring waste material due to quality control and reducing waste material.
- 3- Time
- Faster completion of projects due to advance off-site preparations and simplified installation process.
 - Manageable construction schedule by the use of planning control, estimated lead time and forecasted down time.

6. 0) DISADVANTAGES OF (IBS)

- * IBS is not interesting and popular among designers.
- * Lack of understanding of among designers, client and contractors.
- * Slow adoption among contractors with the available systems and high degree of skills, mechanism, coordination and logistic for transportation and erection of the system.
- * The chances of securing a continuous project from government worries the contractor in term of cash flow where the break event point after investing on IBS system.

7. 0) Conclusion

Industrialized Building Systems (IBS) or off-site construction has been introduced to cope with a growing demand of affordable housing, solving issues associated with foreign workers and improving image, quality and productivity of construction related services in Malaysia. The purpose of this survey is to gather information on IBS buildings in Malaysia. Besides that, a visual inspection study was also conducted to observe of any problems related to IBS system. IBS features potential construction system for the future with emphasis on quality, higher productivity and less labor intensive.

Besides the aim of gradually reducing the dependency on foreign labor and saving the country's loss in foreign exchange, IBS provides the opportunity for the players in the construction industry to project a new image of the industry to be at par with other manufacturing-based industry such as the car and electronic industries. The adoption of IBS promises to elevate every level of the construction industry to new heights and image of professionalism. Finally, IBS should be seen as the modern methods of construction where modern and systematic methods of design, production planning and mechanized methods of manufacturing and erection are applied.

8. 0) REFERENCES

Badir, Y. F., Kadir, M. R. A, and Hashim, A. H. (2002) Industrialise building systems construction in Malaysia. *Journal of Architectural Engineering*, Vol. 8, No. 1. Badir, Y. F., Kadir, M. R. A. and Ali, A. A. A (1998) Theory of classification on Badir-Razali Building system classification. *Bulletin of Institute of Engineer, Malaysia*, October. Bing, L., Kwong, Y. W., and Hao, K. J. (2001) Seismic behaviour of connection between precast concrete beams. *CSE Research Bulletin*, No. 14

Cheong, G. K. (1996) " The Bayshore Condominium prefabricated construction. *Precastech Newsletter On Line*. Volume 7

Cheong, G. K. (1997) Fully precast system at Choa Chu Kang. *Precastech Newsletter On Line.*, Volume 8. CIDB Singapore (1992) Raising Singapore's construction productivity. CIDB Construction Productivity Taskforce Report.

Din, H. (1984) Industrialised building and its application in Malaysia. Seminar on Prefabrication of Building Construction, Kuala Lumpur.

IEM (2001) A need for new building technologies. Bulletin of Institute of Engineer, Malaysia, February.