Global Journal of Pure and Applied Mathematics.
ISSN 0973-1768 Volume 12, Number 3 (2016), pp. 2367–2373
© Research India Publications
http://www.ripublication.com/gjpam.htm

Preliminary Study on Safety during Precast Concrete Installation in IBS Construction

Mohd Faiz Mohammad Zaki
School of Environmental Engineering,
Kompleks Pusat Pengajian Jejawi 3,
Universiti Malaysia Perlis,
02600 Arau, Perlis, Malaysia.

Wan Zuki Azman Wan Muhamad
Institute of Engineering Mathematics,
Universiti Malaysia Perlis,
Kampus Pauh Putra,
02600 Arau, Perlis, Malaysia.

Afizah Ayob and Muhammad Qayyim Suhaimi
School of Environmental Engineering,
Kompleks Pusat Pengajian Jejawi 3,
Universiti Malaysia Perlis,
02600 Arau, Perlis, Malaysia.

Abstract

The emerging technology of Industrial Building System (IBS) has gained momentum as an intervention to improve the safety among workers. The objective of IBS is clearly moving toward sustainability and promote the safety aspects. However, numerous barriers including improper practicing in IBS installation leads to greater risk including fatalities. There are several cases of failed in IBS construction projects as reported and occurred due to lack of technical knowledge and expertise. The potential factor contributes to this safety issue and awareness among practitioners in IBS technology investigated through this research. The area of study focused in Selangor since the implementation of IBS construction rapidly growth in this state. This research methodology conducted based on the preliminary interview with the experts in IBS industry. Structures of the questionnaire were designed by taking into consideration their suggestions and finally distributed to the respondents with the aim to assess their understanding and awareness regarding the safety in IBS construction. The viewpoint of practitioners in IBS construction, including

contractors and consultants was collected and analyzed through the quantitative approach. The result has shown 64.3% of the respondents, agreed that workers are the major factor that cause an accident, especially during the installation of precast concrete on site. 45.7% of total respondents, which consists 1-3 years experience in IBS construction was demonstrating their awareness and recognize the function of authority bodies such as Department of Occupational Safety and Health (DOSH).

AMS subject classification:
Keywords: IBS, safety, awareness, precast, safety.

1. Introduction

The conventional building method is defined as components of the building that are pre-fabricated on site through timber or plywood formwork installation, steel reinforcement and cast in-situ. Conventional buildings are mostly built of reinforced concrete frames with the traditional construction method using wooden formwork [1]. Conventional construction is a common practice in Malaysia; it consists of a reinforced concrete frame and brick, beam, column, wall, and roof, which are cast in situ using the timber framework while steel reinforcement is fabricated off-site. This process can be hampered by quality issues, unfavorable site conditions, a skilled labor shortage, and bad weather conditions [2]. Based on these issues, the new innovative technology of IBS was developed. The industrialized building system is defined as a construction technique in which components are manufactured in a controlled environment on-site or off-site, transported, positioned, and assembled into a structure with minimal additional site work [3].

The broader view of the industrialized building system (IBS) is about changing the conventional mindset, championing human capital development, developing better cooperation and trust, and promoting transparency and integrity [4]. The sustainability principles in the IBS have always maintained the harmony between environment and construction, improve human self-respect and encourage economic development to strive for a better quality of life [5]. IBS is also considered as a Modern Method Construction (MMC). MMC is the term used to describe a number of innovations in house building in particular, and construction industry in general, mostly adopting off-site technologies by moving work from the construction site to the factory [6].

Apart from all the advantages the system can offer, site observations carried out revealed that there are still weaknesses found in the site management. Site management in IBS is crucial when dealing with the material and equipment workplace and could help in planning process of the project [7]. A sequence of events resulted in work accidents. They arise from different causes that can generally be classified as physical incidents posing hazardous situations and behavioural incidents caused by unsafe acts [8]. The components transport to site should properly handle and installed with the right procedures. During keeping the IBS components at site, problems should be avoided such as limited space of storage and safety of the materials are not guaranteed to avoid project delay. Space provided for storage should be critically identifies before components were

transported to site. Erection of hoarding surround the site area will avoid the components from theft and increase safety of the materials [7].

2. Methodology

A questionnaire was developed and distributed directly to the 70 of respondents to collect the general information and assess their awareness regarding the safety issues in IBS construction site. The questionnaire consists of several sections; Section A and B using Closed Ended Questions.

Section C, D and E used Likert Questions, measure all dimensions (1 = strongly agree, 2 = agree, 3 = Neutral, 4 = Disagree, and 5 = strongly disagree). All respondents were chosen from the Malaysian IBS practitioners. Three main respondent groups involved in the Malaysian IBS projects (designers, contractors, and manufacturers or suppliers) were chosen via stratified sampling technique. After the identification of the strata, the weight and importance of each stratum of the population are determined. The sample size (n) is then divided based on the weight of each stratum, and the members are selected randomly from each stratum to form a consistent and representative sample [9]. In this test, the Cronbach′s Alpha is the main parameter that being considered. The value of 0.7 is considered as the lowest boundary to ensure the survey questions prepared is reliable and appropriate for this research. In the pilot test, the Cronbach′s Alpha resulted in 0.849. This research focussed about the safety during the installation of pre-cast concrete components. The types of company that have been involved are contractor and consultant that registered with CIDB for installation of pre-cast concrete components.

3. Grade of Company

Figure 1 shows the grade of the company that used pre-cast concrete components for their project. Most of the companies are grade 7 with their numbers is 34 out of 70 respondents. From the data and research that have been observed, the companies hold grade 7 normally involved in the mega projects such as shopping mall, universities campus, high-rise building and apartments. Technically, they must aware the factors that lead to accidents at site work and the safety precaution method during construction based on their experience, quality and management of construction especially in IBS projects.

4. Results and Discussions

Table 1 shows the general factors that cause the accidents on site. Based on the result, 64.3% of the respondents agreed that workers play a significant role in contributing the accident especially during the installation of precast concrete on site. The key aspect leads to this issue is improperly wearing the personal protective equipment (PPE) amongst workers. Thus, indirectly increase the potential to trigger an accident.

Table 2 illustrates the years of experience gained by the respondents in IBS construc-

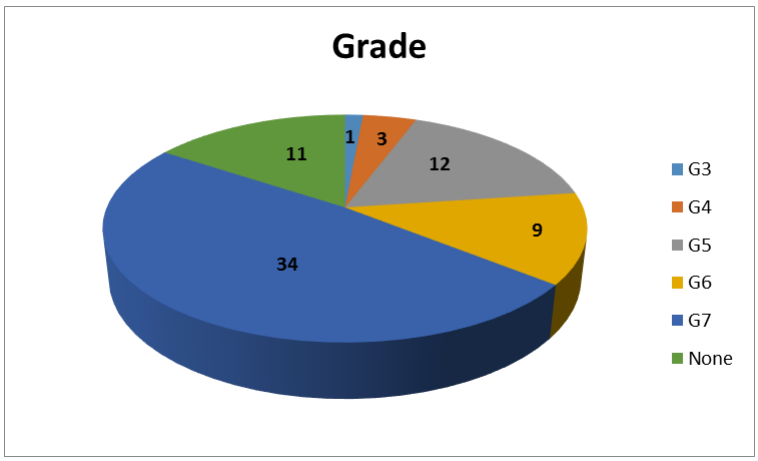

Figure 1: Grade of Company

Table 1: General Factor of Accidents at site work

General Factor of Accident	Frequency	Percent (%)
Workers	45	64.3
Equipment/Machinery	13	18.6
Different Procedures	9	12.9
Site Work	3	4.3

tions. The largest group of respondents, about 45.7% of respondents consists from 1 to 3 years working experience in related IBS construction industry. This part of information is highly required to assess the fundamental knowledge of respondents regarding the safety issue and safety awareness, especially to those who are involved in IBS industry within ranges 1 to 3 year experience, since under this category, respondent considered as new players in IBS industry.

This section focused on the implementation of safety aspects, especially procedures in handling the equipment and machinery during the installation of precast concrete. This question tends to assess the level of awareness amongst the respondents regarding safety issues.

Each equipment or machinery to be used during the installation activities should be checked and approved by the authority (DOSH). Hook for lifting cable extremely required while IBS components to be raised should be strong and stable to prevent these components fall onto the ground. When installing the precast concrete components, its procedure should be consistent and meet the requirement as directed by CIDB. Majorities of the respondents answered strongly agree to this question. Based on this, most of the respondents shows their awareness and commitment to comply the need of regulatory authorities. This indirectly shows the functions and scope of authorities in IBS industry.

Table 2: Experienced of Employees in IBS construction

Year	Frequency	Percent (%)
0 years	8	11.4
1-3 years	32	45.7
4-5 years	18	25.7
5- above years	12	17.1

Table 3: Section C (Equipment and Procedure)

	N	Mean	SD
Score C	70	1.3690	0.30809

Table 3 shows the result based on the statistic analysis for this section. Standard deviation presented as 0.30809 and mean value of 1.3690, approximately 1 demonstrated most of the respondents in this survey quote strongly agree for this section.

Table 4 shows the result obtained for section D, which is related to workers and employers. The company should invest and appoint skilled workers in IBS construction. A skilled worker is important in order to ensure the IBS construction is run smoothly. In this section, a standard deviation is 0.41692 and mean value obtained is 1.5095. It can be concluded, half of the respondents under this category selects strongly agree and the rest is agree.

Sections E was designed to consider the aspect of site work. The task and role of safety officer are to perform the daily routine, including monitoring the construction site every day. Communication is important during the installation of precast concrete and precaution method such as signboard must be located properly to minimize the possibility of accidents. From the Table 5, standard deviation obtained is 0.34838 and mean value from this section is 1.4143. This results showed respondents quotes strongly agree slightly higher than the respondent who are quote agree.

Table 4: Section D (Workers and Employers)

	N	Mean	SD
Score D	70	1.5095	0.41692

Table 5: Section E (Site Work)

	N	Mean	SD
Score D	70	1.4143	0.34838

5. Conclusion

As a conclusion, awareness level regarding the safety in Industrialized Building System (IBS) in Selangor reaches to the level where majorities of employees understand their role in safety aspects, particularly in IBS construction regardless their positions. Most of the respondents especially with 1 to 3 years working experiences in IBS industry have the similar opinion with the expert in IBS construction, including handling the equipment and machineries during the installation of pre-cast concrete properly, invest and appoint skilled workers in IBS construction, safety officer are required to perform the daily routine including supervising the construction and employees have good communication skills during installation of IBS components shows respondents have high of awareness levels regarding the safety aspects in IBS construction.

References

[1] N. A. A. Bari, N. A. Abdullah, R. Yusuff, N. Ismail, and A. Jaapar, "Environmental awareness and benefits of industrialized building systems (ibs)," *Procedia-Social and Behavioral Sciences*, vol. 50, pp. 392–404, 2012.

[2] E. Lou and K. A. M. Kamar, "Industrialized building systems: Strategic outlook for manufactured construction in malaysia," *Journal of Architectural Engineering*, vol. 18, no. 2, pp. 69–74, 2012.

[3] I. Roadmap, "Roadmap 2003-2010," *Construction Industry Development Board (CIDB, Kuala Lumpur, 2003)*, 2003.

[4] S. N. Shaari and E. Ismail, "Promoting the use of industrialised building systems (ibs) and modular coordination (mc) in the malaysia construction industry," *Bulletin of Institute Engineers Malaysia*, vol. 14, 2003.

[5] S. S. Kamaruddin, M. F. Mohammad, and R. Mahbub, "Enhancing the quality of life by adopting ibs: an economic perspective on mechanisation and automation," *Procedia-Social and Behavioral Sciences*, vol. 101, pp. 71–80, 2013.

[6] W. Pan, A. G. Gibb, and A. R. Dainty, "Perspectives of uk housebuilders on the use of offsite modern methods of construction," *Construction management and Economics*, vol. 25, no. 2, pp. 183–194, 2007.

[7] F. Ismail, H. E. A. Baharuddin, and M. A. Marhani, "Factors towards site management improvement for industrialised building system (ibs) construction," *Procedia-Social and Behavioral Sciences*, vol. 85, pp. 43–50, 2013.

[8] F. Ismail, R. H. Salimin, and R. Ismail, "The organisational environment-behaviour factor's towards safety culture development," *Procedia-Social and Behavioral Sciences*, vol. 35, pp. 611–618, 2012.

[9] R. F. Fellows and A. M. Liu, *Research methods for construction*. John Wiley & Sons, 2015.