

# Occupational safety and health in construction industry management (OSHCIM) implementation – Academician’s perspectives

**Hamizah Liyana Tajul Ariffin<sup>1</sup>, Norhazren Izatie Mohd<sup>1</sup>, Noor Nabilah Sabrini Lim Carmen<sup>1</sup>, Kamarizan Kidam<sup>2</sup>, Mohammad Ismail<sup>2</sup>, Kherun Nita Binti Ali<sup>1</sup>, Nur Emma Mustaffa<sup>1</sup>, Jafri Mohd Rohani<sup>2</sup>, Samsiah Abdullah<sup>1</sup>, Nazruddin bin Mat Ali<sup>3</sup> and Muhammad Syaiful Ahdad M Fetri<sup>4</sup>**

<sup>1</sup> Faculty of Built Environment and Surveying, Universiti Teknologi Malaysia

<sup>2</sup> Faculty of Engineering, Universiti Teknologi Malaysia

<sup>3</sup> Department of Occupational Safety and Health (DOSH), Malaysia

<sup>4</sup> Construction Industry Development Board (CIDB), Malaysia

Email: hamizah@utm.my

**Abstract.** The high incidents number of injuries and fatality rates in the construction industry are generally due to hazards on site. Early intervention of hazards could lead to safer construction processes. The Safety by Design (SbD) is a process that identifies hazard and assesses risks early in the project design stage, in comparison to during the construction stage. A study in Spain shows that there is still lack of emphasis on the SbD concept in higher education although the concept had been implemented for quite some time. The lack of tertiary education regarding SbD could lead to insufficient knowledge for the effective implementation of SbD by future professionals. As for the Malaysian construction industry, SbD will be soon implemented as the Guidelines on Occupational Safety and Health in Construction Industry (Management) – OSHCIM. Therefore, this paper sought to review the perception of academician regarding OSHCIM implementation. The quantitative strategy is adopted, and a set of questionnaires are distributed among academicians involved in educating architecture, civil engineering, quantity surveying, mechanical and electrical engineering courses in Malaysia’s Institute of Higher Learning. The research indicates that most of the academicians appear to agree that sufficient knowledge and the right attitude is essential for the successful implementation of SbD education in university. It seems that all academicians from different background have higher attitude mean score compared to their knowledge mean score. Even though some of the academicians might not be familiar with the concept, most of the academician was not against it and had a positive attitude towards it.

## 1. Introduction

Traditionally, safety in the construction industry was broadly seen as the contractor’s responsibility [1]. However, the objective of zero injuries could not be achieved by solely depending on the construction firms only. It is necessary to include all parties involved in a construction project such as client, designers, engineers and quantity surveyors to ensure the safety of workers and elimination of hazards in the construction site. The reduction of accidents in construction industry by design and planning was



Content from this work may be used under the terms of the [Creative Commons Attribution 3.0 licence](https://creativecommons.org/licenses/by/3.0/). Any further distribution of this work must maintain attribution to the author(s) and the title of the work, journal citation and DOI.

a thought that encouraged designers to identify health and safety risks and propose solutions during the project design stage, instead of carried out that process in the construction stage [2]. Hence, Department of Occupational Safety and Health Malaysia (DOSH) have set up a national initiative, known as Safety by Design (SbD), to prevent or reduce occupational injuries, illnesses, and fatalities by including prevention considerations in all designs that might affect workers. Parties involved within the early stages of constructing a project should, therefore, learn the basic principles of Occupational Health and Safety (OHS) and understand how to apply them within the design stage [3]. Therefore, there is a need to incorporate Safety by Design education into the program syllabus of higher education for students to fully understand their OHS responsibilities together with their professional competencies [4].

## 2. Problem statement

The frequent occurrences of accidents in the construction sector have resulted in many manpower and property losses each year in Malaysia. Construction projects can never attain its objectives unless construction professionals are aware of the existing safety issues [5]. Providing a safe working environment is among the steps to develop the right image for the construction industry. The concept of Safety by Design is defined as the thought of construction site safety early during the project design stage. It is proven that successful implementation of the Safety by Design concept has a significant impact on the safety and health of workers in the construction industry [6].

However, Lopez [7] found that in the university courses of architecture and engineering in Spain, there is a lack of emphasis on the education of the Safety by Design concept although it had been implemented for a long time in the country. The lack of tertiary education regarding safety by design can easily lead to insufficient knowledge for the effective implementation by future professionals. Although it is proven that the concept of Safety by Design is able to improve the safety and health performances in the construction site, many injuries still occurred because it is poorly implemented by the engineers and architects.

“Guidelines on Occupational Safety and Health in Construction Industry (Management) – OSHCIM” is the Safety by Design guidelines that will be implemented very soon in the construction industry of Malaysia. In order to prevent the issue where Safety by Design concept is not clearly integrated at the university level, Malaysia’s academicians play a vital role in educating future construction professionals.

## 3. Literature review

### 3.1 An overview of Safety by Design

Safety by Design is a process that identifies hazard and assesses risks early in the design stage. This process deliberates how to eliminate and minimize the risk of injury and fatality cases to those who construct, maintain or demolish a construction building [3]. The primary purpose is to make the right design decision as soon as possible to improve project safety. These decisions might include appropriate materials used, equipment selection, construction method and provision of maintenance [3].

### 3.2 Parties involved in the design stage

Safety by Design is a health and safety risk management process. All possible site safety risks throughout the lifecycle of a construction project will be identified during the design stage. Designers, as the leading player during design stage, are in the position where they are able to ensure the safety of the work on-site from the start. According to the Occupational Safety and Health Administration (OSHA), they believe that if we could get engineers and architect to pay attention to the safety measures to be implemented from the beginning of the design stage, it will lead to improvement of safety and health performance in the construction site [4].

The quantity surveyor often acts as a specialist advisor to the designer regarding all matters concerned with building cost. Therefore, the quantity surveyor should be included at the earliest possible stage for the design of the building. They are able to offer advice that considers the economic effect of

design proposals so that the available budgets can be put to the best possible use. By doing so, it can help in ensuring that both client's budget and requirement can be achieved [8].

The concept of Safety by Design is usually related to the designer's discipline. The architect usually will have a more positive impact on the Safety by Design concept compared to civil, mechanical and electrical engineers. However, according to [4], the Safety by Design process shall include mechanical and electrical engineers as well. Therefore, it can be concluded that architect, civil engineer, quantity surveyor mechanical engineer and electrical engineer are the parties that should be involved in Safety by Design of a construction project.

### *3.3 The perception of Safety by Design concept*

According to [9], there are still challenges for designers to carry out Safety by Design measures, although it had been implemented for years in the UK construction industry. This is mainly due to designers not considering occupational safety and health as part of their work. In order to overcome this issue, the European Union has even adopted national laws in order to ensure that construction site safety is taken into account during the design process [10].

While on the other hand, [4] cited that contractor fully supports the Safety by Design concept, and they believe that architects and engineers should be provided with education in health and safety. The design professionals should know how the building will be constructed by the contractor and include consideration of practical safety requirements during the design stage of a project. This is mainly due to design professionals being in a position where they are able to make decisions during the design stage. All in all, different construction professionals will have different opinions regarding the implementation of Safety by Design concept. As for this study, the perception of academicians from different departments will be identified based on two major categories, which are the knowledge and attitude of academicians towards the implementation of Safety by Design concept in Malaysia.

### *3.4 Possible ways to embrace Safety by Design in higher education*

As for education, the disciplines of engineering, architecture, and quantity surveying most frequently are identified as prime opportunities for Safety by Design education. Intervention development has already begun in the United States, as NIOSH has developed four Prevention through Design (PtD) lecture modules: reinforced concrete design, mechanical and electrical systems design, structural steel design, and architectural design and construction [11].

There are a few possible ways to embrace Safety by Design in higher education. These include education through integration into existing subject, provide safety by design training and education to academician before they provide lecture to the students, provide sufficient educational materials, cooperate with companies and local authorities, formal inclusion of safety by design in education and improve teaching approach to the vocational area of student area to help ensure that students can understand the concept of Safety by Design easily.

## **4. Methodology**

### *4.1 Research sampling*

The target respondents were focused on the academicians who are teaching in Architecture, Civil Engineering, Quantity Surveying, Mechanical Engineering and Electrical Engineering courses in research universities of Malaysia. From the literature review, these five professions are the key participants during the design stage of a construction project, and sufficient Safety by Design education shall be provided for the students from these departments.

The main objective of sampling is to ease the data collection process and make it more practicable with good outcomes or results for the research [12]. The sampling method that was adopted in this research is stratified sampling (unbiased). Stratified sampling was used where groups were formed specifically to represent different characteristics within the population, such as 5 different groups of university courses in this research. Within each group, a random sample is taken, usually based on

proportion to the size of the group. Stratified sampling can lead to a perfect random representative sample as the opinion of each group will be addressed equally.

Currently, there are a total number of 114 academicians in architecture, 134 academicians in civil engineering, 50 academicians in quantity surveying, 308 academicians from mechanical engineering and 221 academicians from electrical engineering for five of the research universities in Malaysia. These numbers include all academicians involved in these 5 different programmes respectively. Table 1 below shows the population of academicians who educate students from architecture, civil engineering, quantity surveying, mechanical engineering and electrical engineering courses in research universities. The total population of academicians in construction-related courses of research universities is 827 people. Therefore, the sampling size was 265 academicians as shown in (Table 2) based on the Krejcie and Morgan’s table.

**Table 1.** Total number of Academicians from different courses

Research Universities	Numbers of Academician				
	Bachelor of Architecture (Honors)	Bachelor of Civil Engineering (Honors)	Bachelor of Quantity Surveying (Honors)	Bachelor of Mechanical Engineering (Honors)	Bachelor of Electrical Engineering (Honors)
Universiti Malaya (UM)	17	25	17	62	33
Universiti Kebangsaan Malaysia (UKM)	21	17	-	37	53
Universiti Putra Malaysia (UPM)	28	29	-	31	33
Universiti Sains Malaysia (USM)	16	35	9	40	63
Universiti Teknologi Malaysia (UTM)	32	28	24	138	39
Total number of academician according to courses	114	134	50	308	221
Total number of potential respondents	827				

**Table 2.** The sample size of Academicians based on population

Population	Sample Size
827	265

**4.2 Research method**

Generally, this research was applied the quantitative method for data collection purpose. The quantitative method will be applied to achieve the objective where questionnaire will be distributed to target respondents to collect data on perception of academician regarding OSHCIM implementation in Malaysia. Quantitative methodology is an investigation to generate data and results using statistical and mathematical techniques. Questionnaire instrument is the most suitable method to collect data for this research objective because it is a fast and economical method when large number of respondents is required [13]. As for this research, the objective requires the perceptions of academicians from five different departments in research universities.

**5. Data analysis**

The raw data has been collected by questionnaire survey form. Out of 300 questionnaires that have been distributed, 50 respondents completed and returned back the questionnaire forms.

**5.1 Demographic analysis**

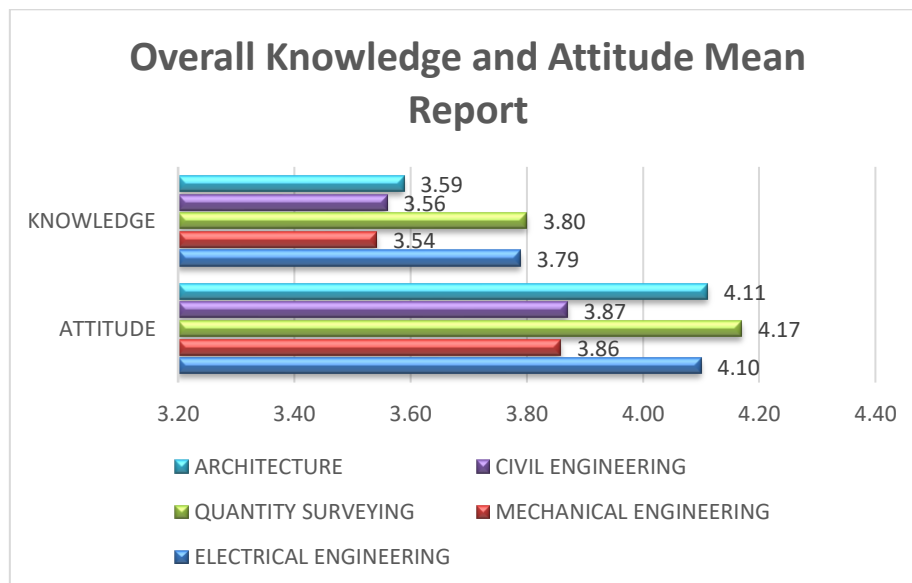
The respondents can be divided into 5 different categories according to their background. These 5 different backgrounds include architecture, civil engineering, quantity surveying, mechanical engineering and electrical engineering. The total quantities of qualified questionnaire collected were 50 sets. Out of these 50 sets of questionnaires, 9 sets are from the architecture background, 10 sets from the civil engineering background, 10 sets from the quantity surveying background, 12 sets from the mechanical engineering background and 9 sets from the electrical engineering background. The categories of qualified respondents from different background have been tabulated in Table 3 below.

**Table 3.** Categories of qualified respondent and percentage

Background	Number of respondents	Percentage (%)
Architecture	9	18%
Civil Engineering	10	20%
Quantity Surveying	10	20%
Mechanical Engineering	12	24%
Electrical Engineering	9	18%
<b>TOTAL</b>	<b>50</b>	<b>100%</b>

*5.2 Results*

From Figure 1 it shows that the average mean score of all academicians with different background ranges from 3.50-4.20 for both knowledge and attitude categories. This shows that most of the academicians tend to agree that sufficient knowledge and the right attitude is essential for the successful implementation of SbD education in the university. According to Behm, (2005) all the designers especially engineers and architect to pay attention to the safety measures to be implemented from the beginning of the design stage, it will lead to improvement of safety and health performance in the construction site. The mean score on the attitude factor shows that all academicians from all different background agreed that having the appropriate attitude is one of the factors to embrace new concept. Furthermore, the observation on the knowledge means score also can be considered as literally high. This indicates that although some of the academicians might not be too familiar about the SbD concept since it was a relatively new concept in the Malaysia construction industry, most of them were not against it and they have a positive and right attitude towards it.



**Figure 1.** Overall knowledge and attitude mean score.

## 6. Conclusion

Occupational Safety and Health in Construction Management (OSHCIM) will be enforced in the near future in Malaysia construction industry. When the time comes, the construction industry will surely need to conduct a safety design review at the pre-construction stage or known as Safety by Design (SbD). In line with this, client and design teams should have a knowledge on the safety to ensure the effectiveness of SbD process. It is believed that the designers must be equipped with safety knowledge from the university level. Therefore, this research was conducted to identify the perception of academician on OSHCIM implementation. The result of the research suggests that the academician believed sufficient knowledge and the right attitude appear to be part of contributing factors for the successful implementation of SbD design education in university. It seems that all academicians from all different background have higher attitude mean score compared to their knowledge mean score. This indicates that although some of the academicians might not be too familiar about what SbD is since it was a relatively new concept in Malaysia's construction industry, most of the academician was not against it and they have a positive and right attitude towards it.

## Acknowledgements

This article is part of on-going research on OSHCIM implementation with funding provided by the Construction Industry Development Board (CIDB), Malaysia and Department of Occupational Safety and Health (DOSH), Malaysia.

## References

- [1] Lew, J., & Lentz, T. (2010). Designing for safety—applications for the construction industry. Paper presented at the W099-Special Track 18th CIB World Building Congress May 2010 Salford, United Kingdom.
- [2] Baxendale, T., & Jones, O. (2000). Construction design and management safety regulations in practice—progress on implementation. *International Journal of Project Management*, 18(1), 33-40
- [3] Cooke, T., Lingard, H., Blismas, N., & Stranieri, A. (2008). ToolSHeDTM: the development and evaluation of a decision support tool for health and safety in construction design. *Engineering, Construction and Architectural Management*, 15(4), 336-351
- [4] Behm, M. (2005). Linking construction fatalities to the design for construction safety concept. *Safety Science*, 43(8), 589-611
- [5] Shamsuddin, K., Ani, M., Ismail, A., & Ibrahim, M. (2015). Investigation the Safety, Health and Environment (SHE) protection in the construction area. *International Research Journal of Engineering and Technology*, 2(6), 624-636
- [6] Goh, Y. M. & Chua, S. (2016). Knowledge, attitude and practices for design for safety: A study on civil & structural engineers. *Accident Analysis & Prevention*, 93, 260-266
- [7] López-Arquillos, A., Rubio-Romero, J., & Martínez-Aires, M. (2015). Prevention through Design (PtD). The importance of the concept in Engineering and Architecture university courses. *Safety Science*, 73, 8-14
- [8] Seeley, I. H. (1996). *Building Economics Fourth Edition*: Macmillan Press Ltd
- [9] Larsen, G. D., & Whyte, J. (2013). Safe construction through design: perspectives from the site team. *Construction management and economics*, 31(6), 675-690
- [10] Brace, C., Gibb, A., Pendlebury, M., & Bust, P. (2009). Phase 2 Report: Health and safety in the construction industry: Underlying causes of fatal construction accidents—External research. Norwich: Her Majesty's Stationery Office. (Accessed on 11/04/2014)
- [11] Heidel, D., 2011. Including PtD into undergraduate engineering courses. Presentation at NIOSH Prevention through Design Conference: A New Way of Doing Business. Washington, DC
- [12] Nastasi, D. (2009). *Quantitative Research: Sampling & Sample Size Considerations*. School Psychology Program. NCVO
- [13] Naoum, S. G. (2012). *Dissertation research and writing for construction students*: Routledge.