



The Practices of Occupational Safety and Health Management in Construction Industry: Case Studies of High Rise Building Projects

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Abstract: This paper presents an investigation of safety practices in occupational safety and health management at high-rise building construction projects in the Klang Valley. Three case studies were selected for data collection. Data was collected through semi-structured interviews with the safety personnel of the respective projects. The findings show that overall construction projects were implemented with safety practices such as safety inspections, safety meetings among construction personnel, education and training for workers, personal protection equipment (PPE) for construction personnel and workers and fall protection systems. Nevertheless, several problems were encountered while implementing the safety practices, which include workers' ignorance of safety working procedures, language obstruction between workers and construction personnel, and lack of awareness among workers. Some of the suggestions given by the interviewees are to provide effective safety training, get full commitment from the top management, impose punishment or penalty on those employees who have irritated the safety regulations and rules, and keep reminding the employees to be aware of their safety as the strategies to decrease problems in safety practices.

Keywords: Safety practices, safety and health management, high-rise construction project, case study, contractor perspective

1. Introduction

The construction industry plays a significant role in contributing to the economic growth of a developing country. The demand for high-rise projects continues to grow due to the reduction of usable land area in the Klang Valley, Malaysia. According to the National Fire Incident Reporting System (NFIRS), high-rise buildings can be classified into four ranges, which are 7-12 stories high; 13-24 stories, 25-49 stories, and 50 stories or more. In general, 75 feet (23 meters) or seven stories will be the cut-off point for most purposes [1].

The rapidly development of high-rise projects has led to the rise of fatalities and accidents. Many of the unpredictable hazards and accidents are present at the construction project, and thousands of workers are injured and killed every year [2]. The most common accidents at high-rise building construction project are workers' falling from extreme height and injuries caused by fallen objects [2]. According to a report from the official website of the

Department of Occupational Safety and Health (DOSH), a total of 4265 accident cases were reported until August 2021, involving 150 cases recorded in the construction sector. There were 48 cases that resulted in death, 196 cases that resulted to non-permanent disability, and the remaining cases that resulted in permanent disability [3]. The number of deaths in construction industry were the highest among other industries (48 out of 123 deaths reported). Therefore, the safety and health issues in the construction project need to be given more attention due to the frequent development of high-rise buildings in the country.

Scaffolding-related accidents, fall from heights, struck by falling objects, and accidents involving plants and machinery are the four types of common accidents associated with high-rise building projects. The workers are always exposed to the risk of collapse of the scaffolding. Most of the scaffold accidents that occurred were due to the use of defective materials for scaffolding, coupled with the unskilled and careless workmanship in the erection of scaffolds [4],[5]. In the construction industry, falls are not only the most fatal accidents but also the most frequently occurring accidents [6],[7]. Everybody on the construction site has the risk of falling in anywhere and anytime, especially at higher levels [8]. In general, lack of safety measures at construction sites is one of the causes of the occurrence of fall accidents [4]. Struck by falling object accidents can be defined as people who work at construction sites being struck by equipment, private vehicles, falling materials, vertically hoisted materials, and horizontally transported materials [7].

The problems in implementing safety practices can lead to an unpredictable accident and may occur due to the following causes: lack of training, improper equipment and working platform, wrong safety attitude, inadequate housekeeping, failure to use personal protective equipment (PPE), and problems in procurement and subcontracting methods. Lack of training can cause accidents at construction sites [9]. The use of unsafe working platforms may also put workers at risk when the equipment is not properly used, maintained, or stored [10]. Construction workers' safety attitudes are influenced by their understanding and realisation of risk, management, safety rules, and work procedures [11]. Working without wearing any PPE may greatly increase the probability of the occurrence of any undesired accident. Workers may refuse to wear PPE for a variety of reasons, including discomfort with the equipment while performing their job on site and viewing it as a disruptive item to their work output. According to Ali, et al. [12], the International Labour Organization has revealed that some workers feel uncomfortable while wearing any type of PPE, and it indirectly decreases their work performance.

In order to overcome the problems in safety practices implementation, actions against errant contractors and workers should be carried out continuously [13]. According to the Occupational Safety and Health Act 1994, section 24, paragraph [14], employees are responsible for wearing or using at all times any protective equipment or clothing that is provided by the employer. Safety inspection is one of the common forms of analysis to prevent accidents. Inspections are part of a preventive or proactive approach to accident prevention [15]. Training is a necessary and important part of accident prevention policy [16]. Each company should ensure that the training program is an integral part of the instruction given to all men in construction work and make sure they pay particular attention to the safety issues [15]. A safety meeting is a gathering at the workplace which involves all the construction team members to discuss health and safety matters. The purpose of the safety meeting is to ensure that all the construction team are aware of the safety matters [17]. The nature of the construction industry's rapidly changing conditions, associated work hazards, and the characteristics of construction organisations further aggravate the situation [18]. Therefore, it is necessary to implement competent and efficient safety practices to prevent the occurrence of accidents effectively.

However, the current practices of occupational safety and health management for every construction project in Malaysia are still inadequate and unsatisfactory, especially for high-rise projects. Previously, Mohamad Amin (2016) had investigated the current practices of OSH management implemented for Mass Rapid Transit (MRT) construction projects through case studies at 5 different MRT project sites [19]. The findings revealed similarities and differences in OSH management practices implemented at the particular construction project sites.

In relation to this, this study aims to investigate the current practices of occupational safety and health management at the construction site and find a solution to reduce accidents on construction sites, especially for high-rise construction projects. Several objectives have been outlined, which are; to investigate the current safety practices for high rise construction projects; to identify the problems faced in safety practices in high rise construction projects; and to identify the best solution to reduce the problems faced in safety practices for high rise construction projects. The finding provides a significant opportunity to advance the understanding of the current safety management practices for high-rise building projects. Apart from providing knowledge, the outcome of the case study can contribute significantly to reducing the risk of accidents by educating contractors on the importance of occupational safety and health management. At the end of the study, it is expected to be used as a reference by all those who are involved directly and indirectly in site safety management.

2. Methods

This is case study design involved in-depth data collection of the specific events faced by an individual. The data of this non-experimental design's study is collected by using semi-structured interview. This study involved safety personnel who were involved in different types of high-rise building projects. Two instruments were used on this study. The first instruments were literature review to obtain the information related to the safety practices commonly implemented at the workplace. The information was taken and extracted from journals, conference proceedings,

reliable articles and others. The information gathered are used to developed a checklist for interview questions. The second instruments used was the semi-structured interview, which used for collecting qualitative information about the current safety practices for high rise construction project. Three high-rise construction projects were selected for the study cases which is warehouse, celcom office tower and office blocks. To ensure the quality and legality of the information, the interviewees were chosen among individuals who were in charge of workplace safety and health and had worked at the specified construction project for at least three (3) years. The interviewees were asked about the safety practices implemented at their construction project based on the variables collected previously. The subjects were also asked about the problems associated with safety practices employed at their construction project, and their strategies to overcome the problems.

3. Results

Based on the data collected from the case study, a total of three construction site were selected and semi-structured interview were conducted towards 3 safety personnel at the construction site. The background of interviewees is shown in Table 1.

Table 1 - Background of interviewees

Interviewee	Case Study	Designation	Qualification	Working experience
Interviewee 1	Case Study 1	Safety and Health Officer (SHO)	Degree and safety certificate	5
Interviewee 2	Case Study 2	Safety and Health Officer (SHO)	STPM and safety certificate	10
Interviewee 3	Case Study 3	Safety Manager	Master	17

3.1 Case Study 1

The first case study was conducted at a 3-storey warehouse construction project at Ulu Kelang, Selangor with an actual height 60 meters. The semi-structured interview was with a certified safety and health officer (SHO) with 5 years of experience.

Safety Practices Implementing at High-Rise Construction Site

From the Interviewee's point of view, site safety inspection is a procedure that must be carried out to ensure the safety practises on the construction project work smoothly. On this construction project, the safety officer (SO) will conduct weekly safety inspections on the site worker box. The site condition will be reviewed. If there is any hazard that might cause injury to the workers, the SO will take immediate action to rectify the hazards as soon as possible. Also, a monthly inspection of the crane and machinery will be carried out. Interviewee stressed that site engineer should inform or notify the SO to carry out an inspection of the crane and machinery to ensure all the necessities are completed. In term of safety meeting, from the Interviewee's perspective, it is imperative to conduct a monthly safety committee meeting to discuss the current safety issues and site progress of the construction project. The committee will also devise methods to consistently maintain and improve the site safety level. Conventionally, construction personnel and workers will have a safety induction process before entering the site. During the induction process, the SO will make sure all requirements are complied with, such as CIDB, work permits, passports, and identity cards. Following that, all construction personnel and workers will receive "working at height" training as well as instruction on how to properly use personal protective equipment. Interviewee mentioned that another approach to educate workers is toolbox talk. Usually, the safety officer will remind them about the latest issues in safety at construction project. According to the interviewee, the latest toolbox talk on this construction site is a briefing on hazard identification, risk assessment, and control (HIRARC) by the engineer. Furthermore, personal protection equipment is another safety practice implemented at this construction site. Interviewee stated that the basic personal protection equipment that must be worn is safety helmets and safety boots to avoid the probability of accidents happening. The SO will make sure the safety helmets have obtained SIRIM approval and the workers will use the helmets by following the colour code that has been identified. Aside from safety helmets and boots, this construction project also provides other personal protection equipment to the workers depending on the type of work carried out, such as face and eye protection, ear protection, hand protection, foot protection, and respiratory protection. Safety harnesses approved by SIRIM for working at height is also provided. Interviewee 1 stated that for fall protection system, this construction project provides a catch platform and safety nets. Catch platform must be erected along the exterior face of structures to protect the public against falling objects, while safety net is to protect from injury after falling objects from heights. Furthermore, this construction project also provides a hard barricade, safety line and toe board. Interviewee stated that since this construction project is on earthwork stage, the fall protection system will be used later.

Problems in Implementing the Safety Practices at High-Rise Construction Site

According to the interviewee, sometimes when encountering a hazard that cannot be rectified, there will appear another hazard. The attitude of workers appears to show that the majority of the workers lack awareness of safety matters. Some of the workers just want their work to finish faster and ignore safety matters. The interviewee also realizes that communication issues arise due to language obligations between workers and construction personnel, since the majority of the workers at the construction site do not understand Malay.

Strategies to Reduce Problems in Implementing the Safety Practices at High-Rise Construction Site

In connection to the issues that have been experienced by interviewee in implementing safety practises at high-rise construction project, the interviewee gives recommendations on techniques to decrease the problems. Firstly, to make sure the workers follow the rules as instructed by the safety committee, penalty will be imposed by deduction of wages or fine on those who have offended the safety rules and regulations. Secondly, the interviewee stresses that the communication problem is not an easy thing to handle. When communication breakdown happens, the other way to handle this problem is by reminding the workers who understand the Malay language to inform other workers who do not understand the Malay language by using their own language.

3.2 Case Study 2

The second case study was conducted at a 36-storey building tower construction site at Petaling Jaya, Selangor with an actual height of 158 meters. The semi-structured interview was with a certified safety and health officer (SHO) with 10 years of experience.

Safety Practices Implementing at High-Rise Construction Site

Interviewee 2 mentioned that several inspections is conducted at this construction project, one of them is scaffolding inspection. Scaffolding inspection is conducted weekly by competent scaffolder before allowed to apply at the site. Furthermore, lifting activities by using mobile crane are also critical thing that need more attention. Safety inspections on cranes, man signals and lifting supervisors are carried out, verified, and then permit will be issued. Safety officer only give one chance to solve the unsatisfactory thing, if still not satisfied, the crane will reject. Besides, before commencement of formwork activity, there will be inspection of materials and goods to be used. Once inspection is satisfied, casting activity will proceed. Another inspection carried out at this construction project is electrical inspection. All temporary panels will be inspected to ensure in a good condition. In addition, on this construction project, safety meeting is held once a month. At the safety meeting there will be one chairman, one secretary and thirty construction personnel who involved in the construction project. The safety and health officer (SHO) will carry out site inspection before the meeting start. The issues arise in the construction site will be discussed in the meeting. Interviewee mentioned that, before being enrolled to get the worker ID, workers who goes to the site will be inducted. Before the induction process, the documents such as valid passport, CIDB, and work permits will be checked. Once the documents are satisfied, then will proceed with the induction process. Besides, this construction project provides several trainings for workers such as working at height, electrical safety, and lifting activity. These training conducted is based on the issues that always arise in the construction site. In term of personal protection equipment, interviewee stated that the basic personal protection equipment to enter construction project is safety shoes, safety helmet and safety vest. These three items are required when entering the construction site at the ground floor only. Meanwhile, safety harness is required to go to level 1 and above. Interviewee stressed that the use of safety harness is compulsory even for inspection works. Besides, for formwork activity, workers should wear leather shoes, google, and face shield. Another safety practice implemented on this construction site is fall protection system. Interviewee stated that this construction project provides a complete guard rail such as top rail, mid rail or intermediate rail, toeboard, and lifeline. At outer surface of the building will install protection screen to prevent falling objects. Interviewee said that some construction project only installs the lifeline to prevent workers from falling down but no safety harness is provided for workers, however, on this construction project lifeline and safety harness is compulsory.

Problems in Implementing the Safety Practices at High-Rise Construction Site

The interviewee stated that safety concerns among workers is the main problem on this construction project. Workers just want to get work done quickly and do over time without thinking about safety that can lead to risks. SO will always remind if workers keep stubborn, safety officers will sack them from the site.

Strategies to Reduce Problems in Implementing the Safety Practices at High-Rise Construction Site

There are many ways to overcome the problems in the construction site. Interviewee recommended to introduce a penalty system called site pass to construction personnel and workers who do not comply with the safety instruction at construction project. Interviewee stated that, on this construction project, penalty system is very strict. It is depending on the guilty of the offense. If a minor mistake it will give a chance, but if the offense is big, permit will issue out and will be terminated from that construction project. Usually, workers will be given three site passes. Any offense will result in a one site pass. When it up to three times the site pass is granted, workers will automatically terminate from the construction project. Instead penalties, this construction site also practicing Non-Conformity Report (NCR) to construction personnel. When NCR is issued out, RM5000 (per NCR) of claim payment will hold until the issues are rectified and the payment will return back.

3.3 Case Study 3

The third case study was conducted at 27 storey office tower construction site at Petaling Jaya, Selangor with an actual height of 159 meters. The semi-structured interview was with a safety manager with 17 years of experience.

Safety Practices Implementing at High-Rise Construction Site

Interviewee stated that some inspections are conducted at this construction project, which include plant and machinery inspections (e.g., cranes and excavators), daily work inspections by safety personnel, weekly inspections by safety officers, and monthly inspections by the safety manager and project director. Monthly safety committee inspections are also practiced at this construction site. Other safety inspection conducted involved fore extinguisher inspection, first aid kit inspection, personal protection equipment inspection and many more. On this construction site, normally a safety meeting will be held once a month according to the safety plan. Issues discussed in the safety meeting is the policy and target for the safety management at site according to the Occupational Health and Safety Management Certification (OHSAS). Interviewee stated that during safety meeting Hazard Identification, Risk Assessment and Risk Control (HIRARC) is carried out. In addition, the contractor will make a presentation on safety performance in all aspects such as training and many more. In term of education and training, this construction project is conducted safety induction process towards workers. Workers needs to have a biometric and when everything is done then workers are allowed to enter the construction project. Interviewee stated that workers need to attend a specific course according to their task, for example, training for signal man, training on rigging and slinging for lifting activity, training on working at height, and many more. Safety personnel such as safety supervisor also given a training on responsibility and accountability regarding safety. Interviewee stressed that on this construction project, safety vest, safety helmet, and safety shoes is compulsory. Safety harness is required for workers working at height, meanwhile, hot work glove, face shield, and safety helmet is for workers working with hot materials. Furthermore, interviewee mentioned that this construction project provides a hard barricade, safety line and toeboard. Barricade will be installed up to the top level. Construction personnel and workers who wants to go from the ground level to the top floor must wear harness and there must be a lifeline for them to hook.

Problems in Implementing the Safety Practices at High-Rise Construction Site

Interviewee said one of the issues encountered when implementing safety practises at high-rise construction project is a lack of awareness regarding safety matters among construction personnel and workers. Sometimes, when less supervision is given, workers begin to ignore safety practices, especially when it comes to personal protection equipment. For example, workers did not wear safety helmets while performing work because they felt uncomfortable carrying out the work. Besides, Interviewee also mentioned that another problem faced is workers did not follow the working procedures and specifications correctly, such as the arrangement of the correct angle for lifting activities. But, Interviewee stressed that workers at this construction site are always reminded and given a warning to execute the safety culture on the high-rise construction site.

Strategies to Reduce Problems in Implementing the Safety Practices at High-Rise Construction Site

To address issues related to safety awareness among workers at construction sites, Interviewee suggested construction personnel (i.e., site supervisors) always monitor and supervise workers at construction sites. No activities are carried out without supervision of site supervisor. Meanwhile, safety personnel also need to always approach and engage with the workers.

4. Discussion

Based on the finding of the case study carried out at three construction projects, all of the construction project has executed safety practices by conducting daily work inspection, weekly inspection on site worker box, and monthly inspection on crane and machinery, as well as monthly safety committee inspection. Besides, monthly safety meeting is also carried out to discuss the current safety issues by applying HIRARC. To educate and trained workers, induction process is conducted towards construction personnel and workers at the construction site, for example, working at height, electrical safety, and lifting activity. Toolbox talk is also conducted towards workers at the construction site. To guarantee the safety of workers, all of the construction project has provided the safety equipment such as safety boots, helmet, harness and many more. Since, these construction sites is working on height, fall protection system is provided to avoid falling objects and workers falling from height, for example, safety net, guard rail, and catch platform. Table 2 shows that safety practice at the high-rise construction project.

Table 2 - Safety practices at the high-rise construction sites

Safety Practices	Case Study 1	Case Study 2	Case Study 3
Site Safety Inspection	√	√	√
Safety Meeting	√	√	√
Education and Training	√	√	√
Working at Height (WAH) Training	√	√	√
Lifting Activity Training		√	
Personal Protective Equipment	√	√	√
Safety Harness	√	√	√
Fall Protection System	√	√	√
Catch Platform	√		
Safety Net	√		
Midrail		√	√
Intermediate Rail		√	
Protection Screen		√	
Hard Barricade	√	√	√
Safety Line	√	√	√
Toeboard	√	√	√

Regarding the issues in safety practices encountered at construction site, a few numbers of problems were identified which are ignorance of workers on work procedures, lack of awareness among workers, and language obstruction between workers and construction personnel. It shows that human factor has been identified as a major contributor to occupational and health (OSH) issues in construction industry [21].

A few techniques have been proposed to overcome the issues, the findings are shown in Table 3. Most of the case studies suggested that to provide effective safety training, full commitment from the top management, impose punishment or penalty to those employees who have irritated the safety regulation and rules and keep reminding the employees to aware about their safety as the strategies to decrease problems in safety practices. There are recommendations cover three viewpoints for the execution of safety practices such as ignorance of workers on work procedures, lack of awareness among workers, and language obstruction between workers supervisors. It relates with the literature review that already mentioned literature review which is to overcome problems in safety practices, actions against errant contractors and workers should be carried out continuously.

Table 3 - Techniques to reduce problems in safety practices at high-rise construction project

No	Safety Practices	Case Study 1	Case Study 2	Case Study 3
1	Provide effective safety training	√	√	√
2	Impose penalty to the workers who have offended the safety rules and regulation	√	√	√
3	Give rewards to the workers who exhibit excellent safety performances	-	-	-

4	Full commitment from the top administration	√	√	√
5	Approach the workers and always did the engagements with them	-	-	√
6	Apply site pass to employees who do not comply with the safety instructions	-	√	-
7	Practicing Non-Conformity Report (NCR) to the employees	-	√	-
8	Provide occupational safety and health campaign	-	-	-
9	Ask for translator to translate when communication breakdown happened	√	-	-
10	Each activity must be supervised by the supervisor	-	-	√
11	Keep reminding the workers to aware about their safety	√	√	√

The result of these distribution factors explained that construction organization in selected construction project agreed that for safety and health to perform positively improvement strong emphasis and effort should be placed by employer or top management level to take part factor of human behavior into safety management. This will be as one of the main considerations in developing organization planning towards organizational safety goal through good safety behavior by all employer and employee towards occupational safety and health improvement in the construction industry. The huge challenges faced by employer is majority of the construction workers in Malaysia is foreigner where some of them brought the behavior of their home culture, for example do not wear personal protective equipment. In facing this challenge for shaping their behavior towards behavioral safety compliance, employers need to adapt holistic tactics to overcome the problems as recommended. It relates with the literature review that already mentioned in literature review which is human behavior such as level of awareness and attitude of workers are a factor contributing to accidents in construction industry.

5. Conclusion

This study is about the investigation of safety practices implementation at high-rise construction project, the problems associated in implementing the safety practices, and the solution to reduce the problems. This study provides an overview on the current safety practices of occupational safety and health management in construction industry for high rise construction projects. Generally, all the construction project is good and structured as far as safety practices are concerned. Among the safety practices implemented at the construction projects are safety inspection, safety meeting, education and training, personal protective equipment and fall protective systems. Nevertheless, several major problems are encountered while implementing the safety practices such as lack of awareness among workers, language or communication barriers between construction personnel and workers, and workers do not follow the working procedure and specifications. Several strategies have been suggested to reduce the problems, such as to provide effective safety training, to impose warnings to workers who do not comply with safety instructions, to impose Non-Conformity Report (NCR) to the construction personnel and workers, to improve communication barriers when dealing with foreign workers due to language barrier, as well as to introduce a penalty system to employees who break the law on the construction site. Further research is suggested to extend the number of case studies to other states.

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