

Identification of Causes and Mitigation Measures of Construction Fall Accidents of Class A and Class B Contractors in Shah Alam area

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ABSTRACT

The construction industry is one of the most hazardous industries. It is because those who spend their working lives on construction sites have a higher probability of being killed at workplace. Based on the statistics issued by the Social Security Organization (SOCSCO) Malaysia, the number of fatality and permanent disablement cases due to fall accidents at the construction sites is one of the highest rates as compared to other sector. Therefore, this research is intends to identify the cause and safety measure of construction fall accidents in Shah Alam construction sites because there are a lot of high rise buildings project in this state. This study is carried out by doing literature review and getting feedback through questionnaires. In order to find out cause and mitigation measure of fall accident at the construction site, this study used SPSS test such as Spearman's Rho to analyze the data. The finding of this study indicates that "poor safety attitude and behavior of workers" are the main problems in obstructing the implementation of safety procedures and guidelines for construction sites. The responses from the survey also show that "sufficient safety training" and "equipments for working at height" are the adoptable mitigation measure to enhance the workers' safety performance. It is believed that appointing the competent person in inspection and maintenance works and by applying risk assessment in identifying fall hazards could reduce the number of fall accidents.

Keywords: *Social Security Organization (SOCSCO) Malaysia, fatality, safety measure, risk assessment*

Introduction

The construction industry plays an important role in any country's economic development. It establishes the infrastructure required for socioeconomic development while being a major contributor to overall economic growth (Drewer, 1980). However it is also one of the most hazardous industries (Chua and Goh, 2004). According to Gibbs, Hide, Haslam and Hastings (2001), it is commonly known that construction fall accidents have serious implications to the construction industry both in financial and humanitarian terms. Construction fall accidents may cause many problems, such as demotivation of workers; disruption of site activities; delay of project progress; and adversely affecting the overall cost, productivity and reputation of the construction industry (Mohamed, 1999). Therefore it is very important to improve safety in the construction industry. Nowadays, Malaysia is one of the developing countries in the world where it is moving towards an approach that believes all occupational hazards can be controlled through detailed regulations (Fadhlin Abdullah, 2004).

In the year ahead, the construction industry would be challenged by increasingly difficult and complex problems in both engineering and management. According to Hsiao (2006), construction industry is a high risk industry because there is a high risk of accident occurrence. Based on Dangelzer, Francais and Jacquin (2002), common types of construction accident occurred is due to fall accidents. According to the previous study, Abdul Rahim (2003) stated that Malaysia is also one of the countries that are not free from this problem. He also stated that construction fall accident becomes as one of the major problems that contributes to the increasing number of fatalities and injuries in construction industry. Based on Occupational Safety and Health division report, 75% of fatalities were from construction site falls. Fall from height is the number one accident type which contributed to workplace fatalities in the construction sector for the period of 2004 to 2009, which is 34% followed by struck by falling objects (25%) and step on, strike against or by

objects (10%). Fall from height accident is mainly due to fall from scaffolds, fall from platform, fall from ladder, fall from roof and also fall from aerial lifts (Huang and Hinze,2003).

The study adopted Drury and Brill's (1983) scenario analysis to characterize the causes of work-related fatal falls in terms of the individual, the task, tools and equipment used, and managerial and environmental factors. Each accident report was reviewed several times to itemize the detailed causes of fall under each factor. According to Drury and Brill's (1983), individual factors would be classified as bodily actions such as climbing, walking, and leaning against, distraction, insufficient capacities, and the improper use of personal protective equipment (PPE). Task factors include overexertion and unusual control, poor work practices, and the removal of protection measures. Tools and equipment factors included mechanical failure, unsafe ladder and tools, or being pulled down. Management and environment factors included unguarded openings, lack of complying scaffolds, unauthorized access to hazard areas, contact with falling object, and harmful substances.

A review of the literature indicates that finding the factors and causes that influence construction fall accidents has been the passion of many researchers. Previous researchers analyzed the causes of fatalities and injuries that due to construction site fall from five main perspectives, namely unsafe conditions, unsafe actions, human-related factors, equipments and management inactions. (Huang and Hinze, 2003).Reasons are time, cost and quality that are always the main factors considered ahead of safety. Safety issues are always considered secondary and taken as a back seat in construction (Mbuya and Lema, 2002). Based on the research undertaken by Sophie Hide and Sarah Atkinson (2003), they stated that employer's attitudes towards safety also a problem in reducing the number of construction fall accidents.

The Deputy Minister of Human Resources, Datuk Maznah Mazlan has also shown concern on this situation. She said that the problem still happens because many employers do not emphasize on construction workers safety (Harian Metro, 2010). Besides that, increasing in the number of construction fall accident in Malaysia is due to lack of safety awareness among employee that involved in construction industry. (Abdul Rahim, 2003). The attitudes of workers that are unwilling to follow the rules and regulation in construction also will be the causal for the influencing fall accidents to occur (Donald, 1995). Inability of responsible person to identify the risk hazard in working at height and to provide the proper training for their workers also become the obstacles in mitigating this problem (AbdelHamid and Everett, 2000). In order to reduce the number of death and injuries related to fall accidents at construction sites, preventive action needs to be taken. According to the Occupational Safety and Health Administration (OSHA), there are two types of systems to prevent and protect workers from falls which are passive system and active system. Passive system can prevent workers from falling by placing a physical barrier between the worker and the falling hazard such as parapet walls and guardrails. The active systems could protect workers that have already fallen by limiting the fall to a specified distance and also limiting the force that the worker is subjected to such as personal fall arrest systems. (AbdelHamid and Everett, 2000).

Methodology

For the data collection of this research, data would be collected through one set of questionnaires that will be distributed to 79 construction companies located in Shah Alam area. The questionnaires proposed the objective and the relevant information to achieve the information for this study. The type of questionnaires selected for this study is personally administered questionnaires as this study was confined within the organization. The data were analyzed with Statistical Package for Social Sciences (SPSS) version 18.0 for window and Excel. All the outputs were interpreted to get a result further on to get a conclusion of this accepted or restudy. Based on the data, the analyses were mean, variances and standard deviation. For this test of the data, non-parametric test and parametric test are used.

Result and discussion

From the findings, there are five major factors that are contributing to construction fall accidents which are due to construction tools and equipments, workers factor, unsafe actions, unsafe conditions and management

factors. For these findings, the collected data were analyzed using a relative index which is used specifically for the ordinal scale measurement.

Investigate the Causes of Construction Fall Accident in Shah Alam Construction Area.

Table 1.0: Mean Responses of Level of Agreements for Factor Relative to the Construction Fall Accidents in Shah Alam Construction Industry.

Factor	Elements	Relative Index	Mean Response
1.Tools and equipment			
1.1	Defective or improper scaffolding or others structures	0.794	Important
1.2	Unstable Scaffolds	0.812	Important towards most important
1.3	Insufficient or nonexistent guardrails or PPE	0.853	Important towards most important
2.Personal Factors(workers)			
2.1	Improper use of Fall Protection equipment	0.956	Most Important
2.2	Lack of safety awareness	0.888	Important towards most important
2.3	Careless	0.847	Important towards most important
3. Unsafe Action			
3.1	Fail to obey work procedure.	0.875	Important towards most important
3.2	Improper installation and operation of work	0.812	Important towards most important
3.3	Adopting unsafe position or posture	0.735	Important
4. Unsafe Condition			
4.1	Inadequate working space/platform	0.818	Important towards most important
4.2	Poor site management	0.879	Important towards most important
4.3	Poor ventilation	0.647	Moderate tows Important
5.Management			
5.1	Lack of maintenance of access equipment and structures	0.853	Important towards most important
5.2	Insufficient training of workers	0.812	Important towards most important
5.3	Inadequate supervision	0.83	Important towards most important

There are a lot of factors that related to construction fall accidents in Shah Alam Construction Industry. From table 1.0, it shows the mean response to the factors of construction fall accidents in term of level of agreement for the clarity and ease of presentation. Overall, factor 1.3 “Insufficient and nonexistent guardrails or personal fall protection equipment” has shown the highest relative index (0.853) of respondents for equipment factor with “Agree towards strongly agree” mean response. The ranking is followed by factor 1.2 and 1.1 which also received “Agree towards strongly agree” and “Agree”. Both of these factors need to take into account in order to reduce the number of fatalities and injuries related to the construction fall accidents.

In term of key factor related to the workers factor, improper use of Personal Protection Equipment (PPE) came out as the “Strongly agree” in their mean response with 0.956 in Relative Index. On the other hand, lack of supervision and knowledge among involved parties also lead to improper use of PPE problem. Factor 3.1, “Fail to obey work procedure” has shown the highest mean response of respondent with “Agree towards strongly agree” and with Relative Index value of 0.875. Besides that, in aspect of unsafe condition, poor site management has shown the highest index value with 0.879 compared to other factors such as unsafe process or job method. Appropriate site management is important to ensure that proper housekeeping in the workplace in order to provide clean and safe working environment.

For management aspect, most respondents tend to choose “Lack of maintenance of access equipment and structures” as a major cause that contributes to construction fall accidents. This factor came out as the highest mean response of respondent with “Strongly agree” and 0.853 in Relative Index. Inadequate designated person to supervise and to carry out the inspection work also lead to this problem.

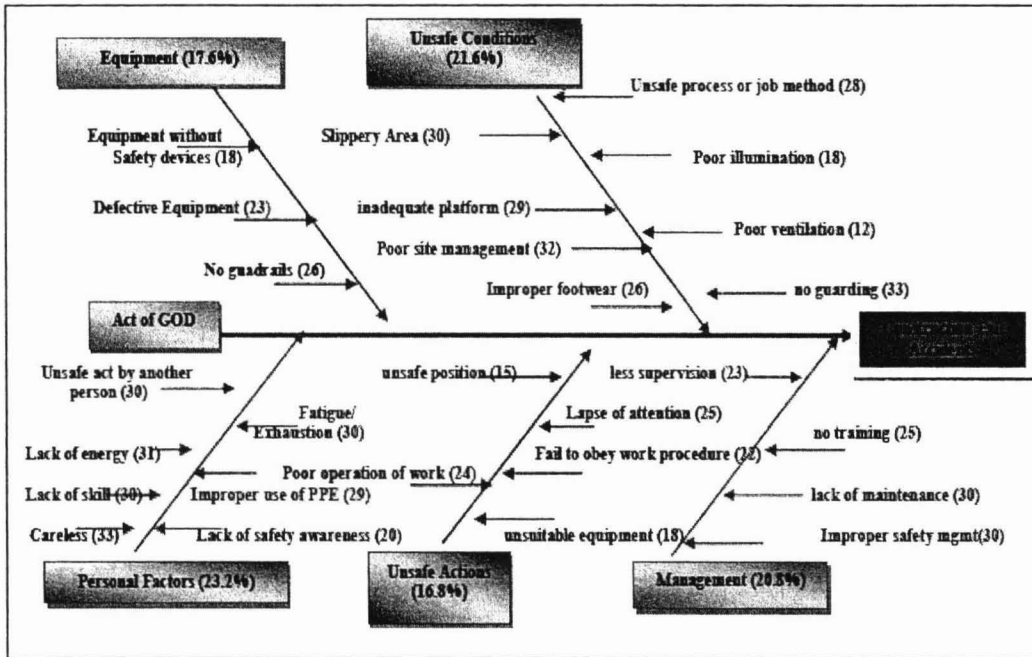


Figure 1.0: Summary of Causes of Construction Fall Accidents from 34 respondents.

Figure 1.0 shows that the causes of fall accidents are more related to the employees rather than the employers as indicated by the result to the Personal Workers Factor (23.2%) as compared to management (20.8%). Besides that, the other factors are equally important as their average percentage of respondent's agreement is quite close such as equipment factor (17.6%), Unsafe Action (16.8%) and Unsafe Condition (21.6%).

In a similar study by Abdelhamid and Everett (2000), they also stated the major factor of construction accident is human factor especially workers. This is because lack of safety awareness and lack of knowledge and skill in job procedure will lead to the unsafe action. Unsafe action can be defined as incorrect procedures and method that have been practiced by construction workers. This problem may be due to insufficient information among workers from the management before they are entering to the jobsite.

In addition, consideration, Lubega et al (2000) stated that lack of safety awareness and poor thinking of workers in safety and health issue are the main point why this accident was happened. For instance, many workers think that Personal Protection Equipment is not necessary for those who have a lot of experience in construction site. It is because since they have been involved in construction work, there are no accidents occurred. This type of thinking needs to be eliminated in order to ensure all of construction workers know that safety is their priority.

Investigate the Mitigation Measures of Construction Fall Accidents in Shah Alam Construction Area

Table 1.1: Mean Responses of Level of Agreements for Mitigation Measures of Construction Fall Accidents in Shah Alam Construction Industry.

Factor	Elements	Relative Index	Mean Response
1.1	Effective maintenance (requires frequent inspection of equipment use to work at height such as scaffolds, platform, ladders, aerial lifts)	0.841	Important towards most important
1.2	Each platform on all working levels of scaffolds shall be fully planked or decked between the front uprights and the guardrail support.	0.853	Important towards most important
1.3	Employer needs to send their employees to safety training in order to provide safety education regarding to the uses of Personal Fall Protection such as body belts and body harness and to ensure that their employees are able to identify the fall hazards when work at height.	0.859	Important towards most important
1.4	Employer needs to ensure that they are provide sufficient Personal fall protection and this equipment needs to be tested before uses.	0.871	Important towards most important
1.5	Responsible person needs to observe their workers when working at high elevation and give a penalty to workers that failed to obey the safety rules.	0.776	Important

Based on the above findings, the respondents identified that Provide sufficient guardrails or personal fall protection equipment as the most important safety measure likely to prevent construction fall accident especially falls of person from height. According to the OSHA 1926.16, it is required that a 42-inch guardrail or other fall protection when working at elevated heights. This finding supports Hinze's and Raboud's notion in that sufficient guardrails and proper use of Personal fall protection such as fall arrest system can reduce the probability of fatalities and injuries that due to falls from height accidents.

Besides that, most respondents also tend to choose "Ensure stable footing of scaffolding" as an important aspect. It is supported by Schriver's (1997) findings, where employer needs to do inspection work in order to ensure that all of the equipment's used in carrying out the work at height were in good condition especially for scaffolds footing.

Based on the result, both of the classes perceived that the five top most mitigation measures were (1) Provide a training programmed in order to improve the workers performance, (2) Employer needs to provide sufficient Personal Fall Equipment, (3) Scaffolds should be set on the base plates and mud sills to provide an adequately firm foundation, (4) Guardrail systems shall be installed along all open sides and ends of the platforms, and (5) Each platform on all working levels of scaffolds shall be fully planked or decked between the front uprights and the guardrails support.

Conclusion

The causes of construction fall accidents in Shah Alam Construction Industry are not significantly different from the other countries as stated in previous research findings. Similar with previous research findings, it was found that workers factor and management inactions are the main factors that will contribute to this problem. In addition, all of the respondents agreed that worker's negligence and careless are the main causes that lead to the occurrence of the construction fall accidents. In addition, employer needs to ensure that all of their workers have enough knowledge and skill regarding their job method before entering the jobsite. As a result of this action, we can increase the safety awareness and also workers' performance. Good understanding in safety will eliminate the cause of construction accident especially due to workers factor. Thus, the employer, employees and other relevant parties must join forces and try to prevent future construction fall accidents by addressing the root causes of accidents.

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