INTI JOURNAL | eISSN:2600-7320
Vol.2019:49

A Study of Fall from Height Accidents in High-rise Building Construction Sites in Selangor

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Abstract

The construction industry is a high-risk industry which is proned to cause accidents resulting in fatalities and injuries compared to other industries. Fall from height is one of the most critical accidents that occurs frequently on high-rise project sites.There is a far reaching implication on the time, cost and quality of the project when safety is neglected on site. Henceforth, this research is presented with the aim of investigating the occurrence of fall from height accidents in the high-rise building construction sites.In order to achieve the aim of this research, data were collected through online distribution of structured questionnaires to safety officers in Selangor area. Frequency distribution analysis, mean score analysis and T-test analysis are employed to analyse the findings of this research.The outcomes of this study enlighten the stakeholders on the site safety knowledge so that effective actions can be implemented to prevent fall from height accident from occurring in high rise building construction sites.

Keywords

Construction accidents, Mitigating approaches, Health and safety at sites

Introduction

Safety issues on construction sites are critical problems in the construction industry (Bakri et al., 2015). Nasrun et al (2016) describes that construction industry as most fraught with danger in relation to personal safety and health. Construction is one of the dangerous industrial activities leading the construction parties to encounter myriad challenges in one environment (Kadiri et al., 2014). Construction accidents, which result in high injury and fatality rates, cause serious impact to the workers and the public (Sousa, Almeida and Dias, 2015). This is due to the nature of the construction activities involved at the worksites. The construction workers are exposed to high accident risks which include fall from height, slip fall, trip fall (Courtney et al, 2001),struck by falling objects, electrocution and lifting operations (Rahman, 2015).

Department of Occupational Safety and Health (DOSH) reports that construction sector in Malaysia has the highest record of fatal accident rates than other industries (Idris, 2017). Fall from height is one of the major accidents that contribute towards the fatality rates. Zhou and Pang, (2012) indicate that fall from height accidents can be attributed to human, environment, material, equipment and safety technology factors. In view of these, fall from height accidents

International Conference on Innovation and Technopreneurship 2019
Submission: 1 June 2019; Acceptance: 10 June 2019

in the construction sites should be tackled effectively by all the construction parties as it will create adverse effect on the time, cost and quality of the project (Ayob et al., 2018).
Therefore, the purpose of this research is to investigate the occurrence of fall from height accidents in high-rise building sites in Selangor.

The aim of this research is to investigate the occurrence of fall from height accidents in the high-rise building sites. Three objectives have been established to achieve the aim of this research: to identify the factors contributing to the occurrence of the fall from height accidents, to analyse the impacts of fall from height accidents in the construction of high-rise buildings on the project and to suggest the effective actions to prevent the fall from height accidents in the high-rise building projects.

Literature review has been explored on various opinions and findings of other researchers on the factors of fall from height accidents, impacts of fall accidents on the projects and precautionary measures towards fall accidents in the high-rise building construction sites. Fall from height accidents occur due to the personal factors (Nadhim et al., 2016), site conditions (Courtney et al., 2001), weather conditions (Williams, Hamid and Misnan, 2018) as well as tools and equipment (Abdelhamid and Everett, 2000).

The rampant occurrance of accidents, as a whole, results in higher risk exposure (Arunkuma and Gunasekaran, 2018). When accident occurs, it not only affects the lives of the workers, but also inflict the project with substantial loss of money and time.Various researches show that the consequences are loss of productivity and cost of recruiting and training new worker (Arunkuma and Gunasekaran, 2018), bad reputation of contractor and incurring medical expenses for treatment (Perera, 2017), lowering of workers' morale (Pillay, 2014) and,time and cost overrun of projects related (Lee, Chen and Foo, 2018).

The approaches adopted for preventing fall from height accident include fall protection system such as Personal Protection Equipment (PPE) (Hui Liy *et al.*, 2016) and installation of guardrails system, safety training on the proper usage of Personal Fall Protection (Abdelhamid and Everett, 2000), first aid training, penalty for failure to comply safety rules, well-planned housekeeping program (Ali, Kamaruzzaman and Sing, 2010), weekly workplace inspection (Hui Liy *et al.*, 2016), toolbox safety meeting (Nasrun *et al.*, 2016), proper material storage (Hui Liy *et al.*, 2016), sufficient lighting (Zulfadly, 2012) and strict implementation of safety policy (Charehzehi and Ahankoob, 2012).

Methodology

Data are collected via online survey approach based on close ended questionnaire and randomly sent to Safety Officers in the state of Selangor. Likert scales have been used to evaluate the results with T test analysis conducted to test the significance of the results.

The category of Likert Scale is divided into five specific weightages as indicated in Table 1 below.

Likert Scale	Weightage	Average Index
Strongly Disagree	1	1.0≤Mean<1.5
Disagree	2	1.5≤Mean<2.5
Moderately Agree	3	2.5≤Mean<3.5
Agree	4	3.5≤Mean<4.5
Strongly Agree	5	4.5≤Mean< 5.0

Table 1: Weightage and average index for each Likert Scale category (Lee, Chen and Foo, 2018)

Results and Discussion

A total of 415 sets of questionnaires have been randomly distributed to the Safety Officers working in Selangor. Complete respondents received was 58, which constitutes 90% confidence level and 10% margin error of the sample frame. Factors attributed to fall from height accidents are stated below.

Contractor's Management Policy

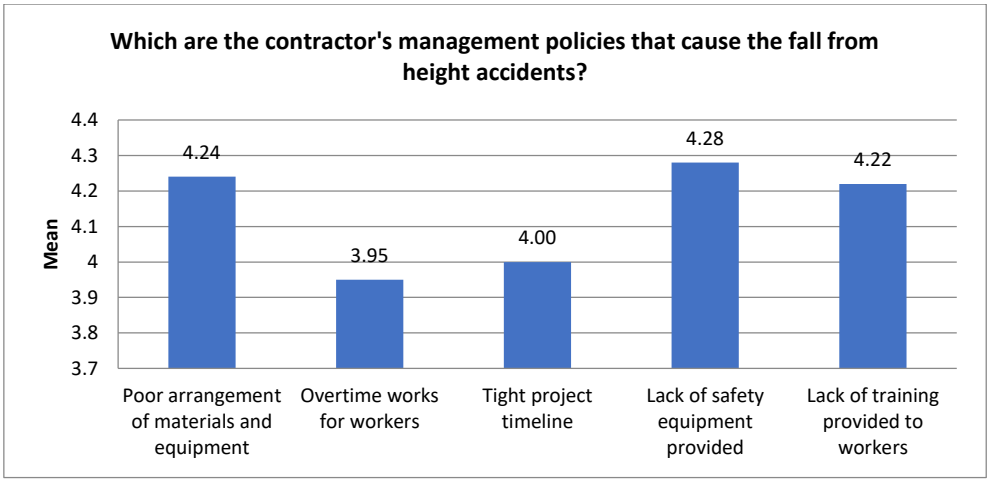

Figure 5.1.1: Respondents' views on factors arising from contractor's management policy

The analysis showed the top three common causes of fall from height accidents are insufficient safety equipment provided (mean score 4.28), poor materials and equipment arrangement (mean score 4.24) and insufficient safety training provided (mean score 4.22) which are classified asagree according to Table 1. The values are significant from T-test result as the population mean is greater than 3.5.

Workers' Behaviour and Attitude

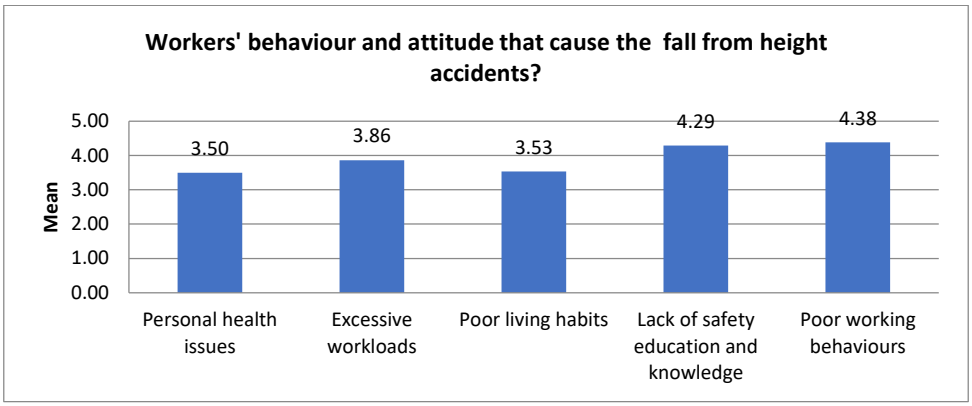

Figure 5.1.2: Respondents' views on factors arising from workers' behaviour and attitude

The three top ranked factors are workers' behaviour and attitude leading to fall from height accidents are poor working behaviours (mean score 4.38), poor safety education and knowledge of the workers (mean score 4.29) and excessive workloads (mean score 3.86). These 3 factors are term 'likely' by the target respondents because the results are significant after going through T-test analysis.

Site Conditions Factors

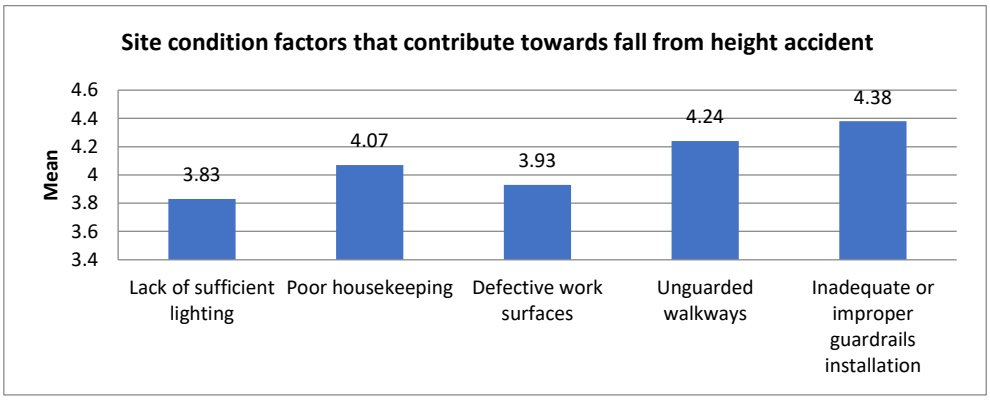

Figure 5.1.3: Respondents' views on factors arising from site conditions

From Figure 5.1.3, the top three likely contributory of site conditions factors give way to fall from height accidents are inadequate or improper guardrails installation (mean score 4.38), unprotected walkways (mean score 4.24) and poor housekeeping (mean score 4.07). The T-test results for these 3 factors are significant and can be categorised as 'likely' by the respondents.

Weather Conditions Factors

The results show the 31% of the respondents agree that weather condition will result in fall from height accident, 29% moderately agree, 23% disagree and 17% disagree having a mean score 3.59 but this factor cannot be concluded as 'agree' as T-test analysis shows it is insignificant and it should be fall under 'moderately agree'.

Tools and Equipment factors

47% of respondents also agree that tools or equipment will lead to the occurrence of fall from height accident, 24% moderately agree, 22% strongly disagree and 7% disagree. The mean score is 3.84. This factor is proves to be significant and it is considered as agreed by the respondents.

Impact of Fall from Height Accident

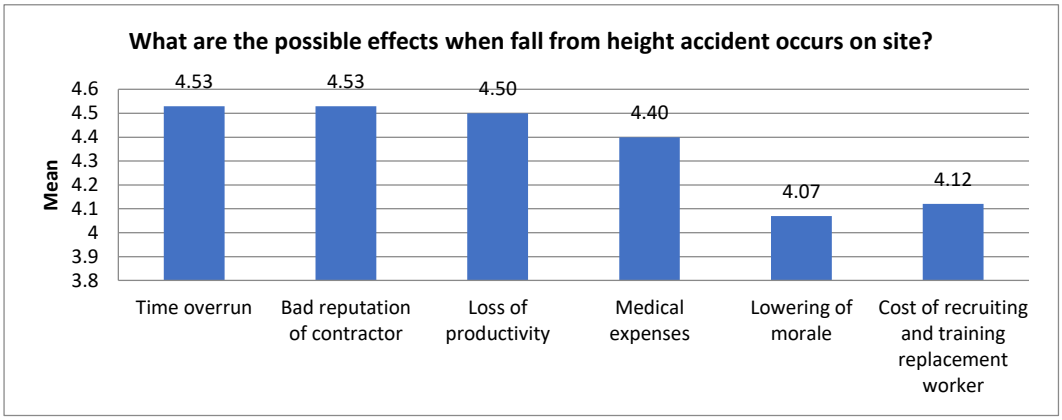

Figure 5.4: Respondents' views on possible effects of fall from height accident

The top three ranked impact are include time overrun and bad reputation of contractor (both mean score of 4.53) and productivity loss (mean score 4.50). The mean scores are under the category of "possible" by the respondents but they cannot be considered as 'highly possible' as the test for population mean of 4.5 is not significant.

Precautionary To Prevent Fall From Height Accident

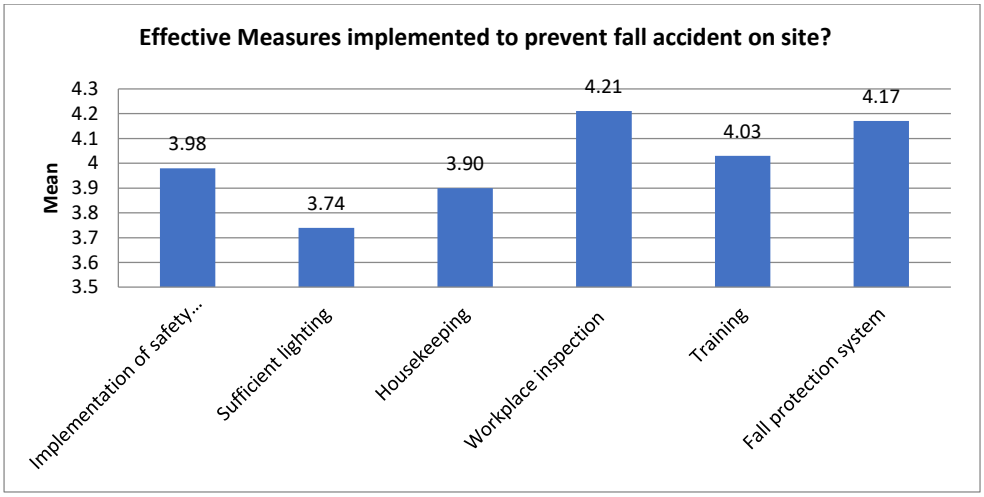

Figure 11: Respondents' views on the preventive measures implemented

From Figure 11 above, workplace inspection (mean score 4.21), fall protection system (mean score 4.17), keeping the workspace clean (mean score 4.39), safety training (mean score 4.03) and implementation of safety culture (mean score 3.98) are the most effective preventive measures to protect people from falling from height. These preventive measures are term "effective" by the respondents as the results are significant.

Conclusions

A high percentage (86%) of the respondents agree that fall from height is a major accident in high rise building sites.The main causes of fall from height accidents are lack of safety equipment provided, poor arrangement of materials and equipment by contractor, bad working behaviour of workers on site, lack of safety knowledge of workers, inadequate guardrails installation and unguarded walkways.Besides these, weather conditions and improper method of using tools and equipment are also the common causes of fall from height accidents.

The findings indicate that the highest impacts of fall from height accidents are time overrun and bad reputation of the contractor. Fall from height accidents occur on the construction sites will cause the project duration to be extended, leading to a delay in the project completion. Meanwhile, fall from height accidents have direct impacts on the reputation of the contractor as the contractor will be perceived as having poor commitment and slack safety policy in their projects.At the same time, loss of productivity results from the investigation into the a ccidents causing interruption of the schedules of planned activities.

To prevent fall from height accidents, contractors must ensure regular work place inspection of high-rise building construction sites so that any potential or existing hazards can be identified early and remedies action promptly taken. Construction companies should also implement fall protection system for every high-rise building project as working at height is a high-risk task. Moreover, adequate and progressive trainings must be conducted for all workers. Other actions that can effectively mitigate the fall from height acciden recommended by the respondents include adherence of HIRARC, adoption of IBS and advanced technologies, penalty imposition and rewards, fall protection plan, adequate safety symbol signage and safety auditing.

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