

Investigation on the Causes of Falling From Height and Fall Protection System at Sabah

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Abstract: The construction industry has been showing progressive growth over the past few years not only in terms of development of projects but also in improvement of safety measures. The bigger the projects are, the higher the risk workers faced in the construction site. This is applicable to workers who are assigned tasks on elevated positions such as high rise constructions as they possess the risk of falling from height. This project aimed at investigating the causes of falling from height as well as fall prevention and mitigation at Kota Kinabalu, Sabah, Malaysia. The research data was collected through survey where close ended questionnaires were distributed to construction companies that performed works related to elevated height. The questionnaires are based on the Likert scale where the respondent measures their level of agreement. The data was analyzed by applying Relative Importance Index (RII). The results show that the highest cause was workers not using personal protective equipment properly, followed by misjudgment and carelessness of workers as well as the usage of defective equipment. For the prevention methods, using personal protective equipment is the best solution to prevent these falls from happening besides conducting regular maintenance check on the equipment.

Keywords: Falling from height, Fall mitigation, Survey, Questionnaires, Likert Scale

1. Introduction

Accidents related to the construction industry has the highest fatality rate compared to other sectors in economic development of the country (DOSH, 2014). Falling from heights are one the common issues that the construction industry faces. Fall from height accidents 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). The aim of this study is to identify the influential causes of accidents due to falls from height as well as assess the fall mitigation preventive methods in the construction industry of Kota Kinabalu, Sabah. The influential causes of falling from height based on previous research includes unsafe acts, unsafe working conditions, communication barriers and also management commitments.

2. Methodology

Data were collected using survey method where questionnaires are prepared based on the literature reviews. The questionnaires were designed as a closed ended type of questionnaire where it was distributed to 33 construction companies which involved multistorey buildings with 66 targeted respondents. The questionnaire was scaled using Likert scale which has a range of 1 to 5. Questionnaires were analyzed using Statistical Package for Social Science (SPSS) software. A total of 45 responses were obtained, then a reliability test was performed to check the feasibility of the questionnaire to be used as an instrument in this study. The data collected was then analysed using the Relative Importance Index (RII) in order to find out the rankings of the causes.

3. Result and Discussion

Reliability Test

The reliability test was done by conducting Cronbach analysis. Table 1 shows the value of Cronbach's Alpha above 0.7 indicating that the questionnaires are acceptable to be used as an instrument for this research.

Table 1. Reliability test result

Cronbach's Alpha	N of items
0.863	26
0.73	14

Causes of Fall

The RII test was done by listing the frequency of responses obtained by each of the questions. The RII value for each of the 26 causes analyzed are ranked. Table 2 shows the RII value of each causes as well as their rankings. The findings from RII test shows that the most common cause for falls to happen in Kota Kinabalu construction site is that personal protective equipment is not properly used, followed by misjudgment or carelessness of workers as well as the usage of defective equipment. This shows that it is in line with the results of previous research where the improper use of personal protective equipment is the main factors are failure to wear PPE, Improper use of tools/equipment, Used defective construction plant/machineries (Abdul Hamid et al., 2008; Cakan et al., 2014, Halipah et al., 2016). The lack of safety inspection in site is ranked as number 4 out of 29 as the probable cause of construction accidents followed by fatigue or sleep deprivation of workers.

Table 2. RII values and ranking of causes of fall

Question	Causes	RII	Rank
1	Prolonged tasks when working in height	0.662	21
2	Age factor (too old or too young)	0.676	17
3	Weight factor (body weight)	0.675	17
4	Misjudgment or carelessness of workers	0.906	2
5	Fatigue or sleep deprivation of workers	0.875	5
6	Insufficient lighting at site	0.826	7

7	The act of erecting and dismantling scaffolding	0.644	22
8	Project timeline (project delays)	0.551	25
9	Improper positioning of equipment such as ladders	0.871	6
10	Working under rain	0.813	10
11	Working under extreme temperature (heat)	0.702	15
12	Working in a noisy environment	0.551	25
13	Improper use of personal protective equipment	0.951	1
14	Workers do not understand safety protocols	0.817	9
15	Usage of defective equipment	0.906	2
16	Workers refuse to cooperate with safety procedures	0.822	8
17	Poor housekeeping (unclean site)	0.724	14
18	Crowded site (small working space)	0.622	24
19	Poor signage (lack of warning signs on edges)	0.764	13
20	Lack of communication between officer and employees	0.786	11
21	Language barrier in terms of reading, writing and speaking	0.626	23
22	Workers do not understand signage	0.671	19
23	Lack of understanding in safety training	0.666	20
24	Poor safety policies by management	0.697	16
25	Insufficient safety training provided by the management	0.768	12
26	Lack of safety inspection in site	0.884	4

Fall Mitigation Methods

This section discusses on the fall mitigation methods. The RII values and rank for each mitigation methods are shown in Table 3. The analysis indicated that Personal Protective equipment such as bodyharness attached to lifeline is the most effective way to mitigate falls from happening with RII scored of 0.982. The second most common practice for mitigating falls is by providing guardrails when working in elevated area (RII=0.978) followed by setting up hole covers on site using durable material (RII=0.973). To further support this, the study by (Halipah et al., 2016) shows that the survey conducted resulted with the respondents strongly agreeing that failure to wear PPE is one of the causes of falls. A survey done by Halipah revealed that the respondents strongly agree with the suggestion of erecting barriers such as guardrails and handrails as the most efficient way to reduce falls in the construction site (Halipah et al., 2016). The fourth ranked common practice for mitigating falls is by providing courses on the usage of scaffolding for workers and followed by providing safety training for unskilled workers.

Table 3. RII values and ranking of mitigation methods

Question	Mitigation method	RII	Rank
1	Provide courses on the usage of scaffolding agents for workers	0.96	4
2	Conduct workshops on safety education for workers	0.902	9
3	Provide safety training for unskilled workers	0.955	5
4	Frequent revision of safety regulations and regular inspections of sites	0.933	8
5	Searching on site potential risks to falling from height accidents	0.942	6
6	Redesign weight for lifting blocks or cement bags for elevated areas	0.826	10
7	Develop new methods to erect and dismantle scaffolding	0.604	13
8	Mitigate or reduce height operations	0.604	13
9	Safety Promotion using banners and posters	0.764	12

10	Provide guardrails when working in elevated area	0.977	2
11	Provide safety net when working in elevated area	0.942	6
12	Safety Monitoring system (hire a safety monitor to prevent fall hazard)	0.813	11
13	Hole covers (cover up holes in site using durable material)	0.973	3
14	Personal Protective equipment such as body harness attached to lifeline	0.982	1

4. Conclusions

The top leading causes of accidents due to falls includes improper use of personal protective equipment, misjudgment or carelessness of works, usage of defective equipment, lack of safety inspection in site as well as fatigue or sleep deprivation of workers. The most influence on causing falls to happen are worker related causes and management related causes although most of it are due to worker related causes.

The top preventive methods for fall mitigation in the construction industry were identified as the usage of personal protective equipment, providing guardrails as well as hole covers in the construction site. It is recommended that inspections on site should be done more thoroughly in regards to the preventive methods that were stated in the questionnaire.

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