

Significant Factors Contributing to Accidents Occurrence on Construction Site

Wan Norizan Wan Ismail, Anis Amalia Mohd Apandi, Siti Sarah
Mat Isa, Norhafizah Yusop, Siti Jamiah Tun Jamil

Department of Built Environment and Technology Studies, Faculty of Architecture, Planning
and Surveying, Universiti Teknologi MARA Perak Branch, Malaysia

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Abstract

This paper aims to determine the significant factors contributing to construction site accidents in the Malaysian construction industry. As the party who carry out the construction work on site, the perception of Grade G7 contractors on the factors was gathered using questionnaire surveys. The 155 responses were obtained and analysed using descriptive analysis. The result reveals that there were nine (9) significant factors causing the construction site accidents namely lack of training, lack of safety culture, lack of regular inspection for material and machinery, lack of measurement of site condition, lack of safety meeting or toolbox meeting, lack of personal protective equipment (PPE), lack of supervision by the supervisor in charge, lack of communication between manager and workers and attitudes of the workers. The findings of this study are crucial and must be put more concerned to reduce the occurrence of accidents and improve construction site safety performance in Malaysia. Adequate planning of activities, investment in safety and safety consciousness should be the major concern by the contractor and needed to be done constantly till zero-accident is realised on every site.

Keywords: Accident, Construction Site, Safety Performance, Contractor.

Introduction

Construction is the most hazardous workplace among various industries. Construction workers engage in many activities that may expose them to serious hazards, such as falling from rooftops, being struck by an object, electrocution or heavy construction equipment, silica, and asbestos dust. Thus, the construction implementation on site requires good safety practices and management. It is an essential element in a construction project which not only to avoid accidents on site but to ensure the successful implementation of the project. This is because once the accidents occur on the construction site, the project performance in terms of time, cost and quality also would be affected.

The contractor is the party that has control over the construction workers and site activities. He has an important role in planning, managing and monitoring the construction works to ensure all related risks are managed and controlled. Hence, he has the responsibility to ensure the safety management and practices are implemented in the construction site. Unfortunately, although the safety regulations and acts have been enacted in the construction industry, however, there is still many reported accidents occur in construction (Nawi et al., 2016). According to Abas et al (2020), the safety performance declined over the years because there is still a lacking in the implementation of regulations and acts that can improve the safety and health management in construction organizations. Hence, this study attempts to investigate the factors that cause the accidents to occur on a construction site from the perspective of contractor as the party that implement the construction works.

Literature Review

Factors Contributing to Accidents on Construction Site

There are many causes of accidents on construction sites that can be found in the literature. In the attempt to ensure safety on the construction sites, Pegula (2013) outlined five parameters that could avoid accidents such as training, temporary traffic barriers, speed reduction, activity area, and workplace safety planning. This guideline can ensure that the workers are safe in their work zone, and the effectiveness of the site safety can also be shown. Meanwhile, Ayob et al (2018); Umar and Bashir (2018) highlighted that the lack of supervision and adherence to safe work techniques, the negligence of workers to wear PPE and comply with the safe use of tools, vehicles and machines as well as lack of installation and maintenance of the temporary traffic control devices are the factors causing the occupational accidents. Nevertheless, the followings are factors contributing to the occurrence of accidents on construction sites considered in this study.

Lack of Personal Protective Equipment (PPE)

Generally, personal protective equipment (PPE) is used to protect workers from any dangers and injuries that might happen on the construction sites. According to Mishra and Shrestha (2017), employers need to ensure that PPE is available on the site because PPE is effective in controlling the risk of injury or ill-health. PPE is provided on the construction site to prevent heat and sunburns because of exposure to the sun for a long period (Sanni-Anibire et al., 2020). Other than that, PPE can also prevent the workers from any physical and chemical injuries on the site. According to Choudhry and Zahoor (2016), the workers also do not want to wear PPE because it is not comfortable. This shows that the workers are the ones that put themselves in danger for not wearing PPE. Sanni-Anibire et al (2020) stated that the workers also need to have the training, provision and enforcement on how to use PPE for the scope of job on the site. The provided training regarding the importance of PPE will make workers aware of wearing PPE while handling and working on road projects. Anak Ikau et al (2019) stated that there are many courses for the participants on wearing PPE and its functions according to the capacity of work, place and situation that were introduced and structured by CIDB. Unfortunately, the lack of provision of PPE by the contractor and lack of awareness on the importance of PPE while carrying out construction works by workers highly contribute to the occurrence of accidents.

Lack of Communication between Managers and Workers

The lack of effective communication between the managers/supervisors with the workers on site could lead to misunderstanding which may cause accidents on site. A good environment of the workplace is a crucial thing that needs to be put first between the workers, especially in terms of communication. Rahman (2019) stated that one of the causes of accidents in the industry is a lack of coordination and communication between contractors and sub-contractors. Communication when working on the project is important to ensure that there is not any misleading information or direction between managers and workers. Substandard workmanship, accidents, delays and misreporting are the consequences that will happen if there is a lack of communication between managers and workers which can also lead to extensive cost and time (Nawi et al., 2016). This shows how important every communication that happens regarding works related to the projects to prevent any injuries and fatalities on the site; false or incorrect communication between managers and workers can lead to these accidents. This is supported by Heng et al (2015) who stated that the communication related to the safety performance on the site can be improved and maintained to enhance a positive on-site safety climate.

Lack of Supervision by the Supervisor in Charge

Nawi et al (2016) stated that the supervisor is known as the intermediate facilitator that can keep the construction site safe. The supervision on the site should not be done regularly but at least once a week to check on the condition of the workers and site. According to Heng et al (2015), it is hard to analyse and track the worker on the site because the workers are always roaming on the sites which will take many hours for individual observation, review and monitoring for the safety management staff time. Most of the site workers neglect the safety rules and procedures when they are not being supervised by the safety supervisor (Choudhry & Zahoor, 2016). In this scenario, the workers need to be supervised by their supervisors to enhance their safety and health on the construction site. Other than that, the injuries and fatalities that happen on the construction site are due to the supervisors not performing their obligation in ensuring that the workers on the construction site are in good condition in terms of health and safety.

Attitudes of the Workers

Even though injuries and fatalities always happen to the workers on the site, it can also happen because of their attitudes during work. Unsafe human attitudes are the cause that records almost 80% of construction accidents (Heng et al., 2015). According to Nawi et al. (2016), the irresponsibility and carelessness of the workers will lead to accidents on the site where they leave the pieces of wood with nails in the walkways, working on sustained scaffolding with a concrete block instead of assembling the scaffolding available on the construction site. To reduce injuries at the workplace, the behaviour-based safety (BBS) system is introduced where it is the systematic application of the psychological approach to human behaviour which focuses on the identification and modification of the critical safety behaviour (Heng et al., 2015). Besides that, Heng et al (2015) stated that face-to-face interviews with the workers who have unsafe attitudes need to be conducted by the safety supervisors, and the report regarding the safety on the site needs to be submitted to the safety officers weekly to ensure that it can assist the safety officers. This implementation in every project can improve their attitudes toward the good application of safety and health on construction sites. Safety performance can be improved by praising and encouraging the

workers' safety behaviour rather than punishing them for their unsafe behaviour (Heng et al., 2015).

Workers Under Influence of Drugs and/or Alcohol

Workers can also have the effect of drugs and alcoholic beverages. They tend to take alcoholic beverages after they do the work on the construction site to release their stress and tension from work. Nawi et al (2016) stated that there is no contractor responsible to conduct tests on the construction workers for alcohol and drugs even though there is an action that can be taken against them in the policies. Drugs and alcoholic beverages can affect their health, which can also affect the productivity of their work and also could lead to accidents on site. To ensure that every construction project has a good quality, the safety and health of the workers are of which very crucial to be taken care of. The supervisor needs to prevent this situation from happening on the construction site to prevent any physical injuries, fatalities and health of the workers from being affected so that the outcome of the project can be of better quality.

Level of Education and Experience

For workers to perform the works safely, they must understand the hazards and risks they face on the job site. Given the transient workforce in the construction industry, certain workers may not always be as familiar with the work being done nor the hazards involved. Unfortunately, in Malaysia the construction labours from Indonesia, Bangladesh and India where they do not have the education in construction projects. In fact, most of them are also unskilled, uneducated and untrained (Durdyev et al., 2017). The uneducated workers on site can lead to many injuries and fatalities because they do not have the knowledge on how to maintain and keep their safety and health, and the danger that can happen on the site. According to Nawi et al (2016), construction workers lack theoretical knowledge and applications where they only have the hands-on skills to do the work on the construction site. Therefore, the training and practice of the importance of PPE need to be introduced to them to ensure that they can have broad knowledge on how to maintain safety and health on the site and can reduce the records of accidents in the construction industry.

Lack of Safety Meeting or Toolbox Meeting

Toolbox talks are one tactic contractor can employ to educate workers. These provide workers 10- to 15-minute informational sessions before a shift that addresses the hazards associated with the tasks they will be performing and how those hazards can be mitigated to help workers perform their tasks safely. Nawi et al (2016) noted that a toolbox meeting is an efficient platform for all the construction workers to gather to take up issues regarding the health and safety on site as it is commonly done before starting the works for the project. Unfortunately, a few supervisors are not alert in terms of the practice of toolbox meetings because some of them have the perception that toolbox meeting or safety meeting is not as important as the part before starting the construction project (Choudhry and Zahoor, 2016).

Lack of Safety and Health Training

The safety knowledge and training are important to enhance the awareness and competence of the site workers to work properly and safely where it can improve the safety culture in the organizations or on the project site, and it can also ensure the implementation of site safety for a long time (Heng et al., 2015). Training is the most important and frequently

stated factor that can enhance the safety and health of the site workers. According to Choudhry and Zahoor (2016), health and safety training is not provided to the employees of the contractors. Therefore, the injury and fatality records do not decrease over the year where the training is not implemented in the construction works. The job-specific training is not introduced to the workers on the site, the training is to ensure that the workers are aware of their safety and health when doing their job (Choudhry & Zahoor, 2016). The workers do not have the knowledge on how to keep themselves safe in the construction environment if they do not attend the training provided by the safety training. To improve the safety training, the industry operators should invest more effort and resources to provide it to the workers before starting construction projects with the collaboration of the Department of Occupational Health and Safety from the Ministry of Labour and Vocational Training (Durdyev et al., 2017).

Lack of Safety Culture

The other factor that can contribute to the construction site accident is the lack of safety culture. Durdyev et al (2017) stated that to implement a good safety culture in a workplace, attitudes and support from the top management of the organization is crucial because it will make the safety performance more effective and efficient. All managements in the organizations need to be alert to enhance the safety and health on the site with the practice of the safety culture where the workers and managers have a good relationship and show good attitudes to prevent any injuries and fatalities from happening. Most construction sites do not implement the safety or OSHA requirement which will lead to the lack of safety culture. The supervisors give work pressure to the construction workers, which only shows the supervision style instead of trying to decrease unsafe behaviours and accidents (Khosravi et al., 2015).

Excessive Overtime Work

The construction industry is a physically demanding labour industry. Many construction workers face fatigue due to long working hours, consecutive shifts, irregular working schedules, night work, early starts, demanding workloads, challenging working conditions and inadequate breaks to ensure that the project can be completed within the completion time. Other than that, working overtime can also make the workers fatigue, and this can affect their performance during working days. If this is not properly addressed by the contractor, the chances of an accident occurring on site is high. According to Zhang et al (2020), the time to do the work on the site becomes less if the workers have the skills in doing their job. To ensure that the construction project is completed within time and has good quality, it does not have to make the workers work overtime because what is important is their knowledge in the construction industry. Koirala (2018) stated that the long period of work on the construction site will lead to mental stress which can also affect the work. Their mental health can also affect the safety performance on the site, which in return lead to the decrease of the quality of projects, and at the same time increases the injury and fatality records in the construction industry.

Lack of Accident Records and Official Safety Data

Choudhry and Zahoor (2016) stated that the published statistical data regarding fatalities and injuries are still lacking. The statistical records of the accidents that occur in the construction industry are important to keep updated and analysed yearly to represent the

awareness of the safety and health implementation in every organization. This lack might be due to the workers do not report the accidents that happened because of the fear of medical treatment and discipline issues which will give a bad reputation and record to the workers (Mishra & Shrestha, 2017). Sometimes, this problem is not because of the management of the projects, but it also comes from the workers who do not want to have a bad reputation which can impact their performance of work. In fact, many workplace injuries are not recorded and documented because of the absence of proper classification or documentation systems and the high number of unregistered workers (Mosly, 2016).

Lack of Regular Inspection for Material and Machinery

Every work in the construction industry needs to have an inspection that should be performed to ensure that the environment, management, safety and health on the site are in good condition. Ayob et al (2018) stated that before starting a project, the employees should make the inspection of materials or vehicles, but most of them will do the inspection only when the equipment or vehicles break down; they do not follow the inspection schedule. Lack of inspection is a factor affecting the safety performance of the construction that needs more attention because most management tends to ignore and not implement the inspection in every pro. Besides that, the management rarely does the inspection because it can take a long period to inspect and increase the cost of the projects. The inspection needs to be taken seriously because this is regarding the safety and health of the workers, and also to ensure that the accident record is decreased and can be prevented.

Lack of Safe Working Procedure

According to Ayob et al (2018), the highest number of fatal occupational accidents are those that happen because of unsafe work environments and procedures. The lack of a safe environment on construction sites is because the environment lacks the safety committee (Durdyev et al., 2017). The site needs to be in very good condition as well as structured; for instance, the materials and plants are stored in proper places, the unused materials are put far away from the working area, while the access and egress on the site are in the right way for the transportation to prevent any injuries and fatalities. According to Sanni-Anibire et al (2020), to ensure that the levels of dust, fumes, smoke and other particles are in the threshold values, measurements of the site need to take place. Dust, fumes, smoke and other particles can also affect the health of the workers, especially their respiratory systems. Workers are not aware of the building plan and exit location, assembly point and emergency evacuation procedure which makes accidents happen, especially during the fire accidents on the site (Koirala, 2018). This is why all the materials, machinery and plants need to be placed properly in a safe place to prevent the workers from being injured and to prevent any accidents from happening on the site. Abas et al (2020) stated that the accidents that happen on the site are because of the failure to adhere to the implementation of a safe working environment which can also increase the cost of the project. The management of the construction project needs to be aware of keeping the site safe for the workers, so that all dangerous events can be prevented.

Table 1

The previous researches on the factors contributing to construction site accidents

Factors that contribute to accidents occurrence on site	Nawi et al. (2016)	Durdye v et al. (2017)	Sanni-Anibir e et al. (2020)	Kolo (2015)
Lack of personal protective equipment (PPE)	√	√	√	
Lack of communication between managers and workers	√			
Lack of supervision by the supervisor in charge	√	√		
Attitudes of the workers	√		√	√
Workers under influence of drugs and alcohol	√			
Level of education and experience	√	√	√	√
Lack of safety meeting or toolbox meeting	√			
Lack of safety and health training		√	√	√
Lack of safety culture	√		√	
Excessive overtime work	√	√		√
Lack of accident records and official safety data	√	√		
Lack of regular inspection for materials and machineries		√	√	
Lack of safe working procedure		√	√	

Methodology

This study used questionnaire surveys as the data collection method. The intensive literature reviews identified there were thirteen (13) factors that have the possibility of contributing to construction site accidents. Hence, the factors were randomly presented for assessment in the way to determine which of them has the highest contribution to the construction site accidents in Malaysia. The five-point Likert scale was used with values on the scale was as follows: 1 as “very low”, 2 as “low”, 3 as “moderate”, 4 as “high” and 5 as “very high” influencing the occurrence of site accidents.

Before the main survey was distributed, a preliminary questionnaire survey was piloted to the safety officers of the G7 contractors to ensure the validity of variables gained from the literature reviews. Out of 30 questionnaires distributed, eleven (11) responses were obtained by the cut-off date given. Next, the reliability test using Cronbach’s coefficient alpha was performed. The Cronbach alpha value obtained was 0.891 (Table 2) and this indicates that the 5-point Likert scale measurement was reliable (Taofeeq and Adeleke, 2019). Hence, the main questionnaire survey could be distributed to all respondents.

Table 2

Reliability Test

Cronbach's Alpha	N of Items
0.891	13

Result and Discussion

Respondents' Demographic Background

The data gathered was analysed using descriptive analysis with the aid of statistical software SPSS version 21. Out of 500 numbers of questionnaires sent out, only 155 numbers returned before the cut-off date (deadline) given representing a 31% response rate (Table 3). The result of this study is weighted to represent building works because 71% were perceptions of respondents based on building works and only 29% based on civil engineering works. All of the respondents were authoritative because all of them were responsible for the safety implementation on site. 23% of them were safety managers, 35% were safety officers and 64% were supervisors. 41% of the total respondents have experience in construction works between 1-5 years, 45% have experience between 6-10 years and 14% have more than 10 years' experience.

Table 3

Demographic background of respondents

Questionnaire survey	N	%
Distributed	500	
Returned	155	
Response rate		30%
<i>Types of construction project</i>		
Building works	110	71%
Civil engineering	45	29%
<i>Respondents' position</i>		
Safety manager	36	23%
Safety officer	55	35%
Supervisor	64	42%
<i>Years of experience in construction</i>		
1-5 years	63	41%
6-10 years	69	45%
More than 10 years	23	14%

Factor Contributing to Accidents at Construction Site

In this study, the factors with the mean values between 4.00-5.00 were considered as the most significant factors contributing to construction site accidents (Shehu et al., 2014; Adedokun et al., 2013; Oyeyipo et al., 2016). Table 4 depicts the result of the assessment where there were nine (9) factors namely *lack of training, lack of safety culture, lack of regular inspection for material and machinery, lack of measurement of site condition, lack of safety meeting or toolbox meeting, lack of personal protective equipment (PPE), lack of supervision by the supervisor in charge, lack of communication between manager and workers and attitudes of the workers* score the mean value between 4.17 to 4.55. Hence, these nine factors were the most significant in contributing to the occurrence of accidents on site. Meanwhile, two (2) factors were found to be moderately influenced with the mean values between 3.26 to 3.44. They were *level of education and experience* and *excessive overtime work*. The two (2) remaining factors exhibited in Table 4 are perceived to have low influence.

Table 4

The Ranking of Factors that Contributing to Accident on Construction Site

Factors Contributing to Accident on Site	Mean	Std. Deviation	Rank
Lack of training	4.55	0.536	1
Lack of safety culture	4.47	0.501	2
Lack of regular inspection for materials and machineries	4.46	0.526	3
Lack of safe working procedures	4.43	0.510	4
Lack of safety meeting or toolbox meeting	4.28	0.529	5
Lack of personal protective equipment (PPE)	4.19	0.556	6
Lack of supervision by the supervisor in charge	4.18	0.586	7
Lack of communication between manager and workers	4.17	0.548	8
Attitudes of the workers	4.17	0.601	9
Level of education and experience	3.44	0.912	10
Excessive overtime work	3.26	1.043	11
Workers under influence of drugs and alcohol	2.95	1.018	12
Lack of accident records and official safety data	2.80	1.256	13

Lack of training was ranked by the respondents as the most significant factor contributing to the occurrence of accidents on site. This is a very significant factor because there are many parties and workers with different educational backgrounds and skills working together at the construction site. It is deemed to understand that the level of knowledge and awareness on safety also would be different for everyone. Providing health and safety information and training could help to ensure the workers are not injured or made ill by the work they carry out (Durdyev et al., 2017). Hence the contractor and the industry player should invest more resources and effort to provide safety training to the workers from time to time to avoid the accidents on site from occurring. The second significant factor was the *lack of a safety culture* in the workplace. Other than the attitude of all the workers on site, this factor is also associated with the level of support from the top management of the firm to implement the safety practices on site. It is very crucial because a safety culture requires cooperation at all levels from the workers up to the top management (Khosravi et al., 2015). The third significant factor was the *lack of regular inspection of materials and machinery*. Carrying out regular inspection and maintenance carried out on the plant and machinery capable to identify and report potential hazards that can be removed or avoided. Hence, lack of inspection and adequate maintenance can lead to dangerous situations, accidents and health problems.

Lack of safe working procedures ranked fourth by the respondents as having a significant influence in causing accidents on site. This finding was in accordance with the study by Ayob et al (2018) which found that the highest number of fatal occupational accidents are those that happen because of unsafe work environments and procedures. Safety precautions for the head, eyes and face during construction work must be taken when they are at risk. *Lack of safety meetings or toolbox meetings* is also an important contributing factor leading to the occurrence of accidents on site. This kind of regular meeting is very important to building a strong safety culture among the workers and preventing them from getting complacent and avoiding taking safety for granted. In addition, holding regular safety meetings could reinforce the firm's commitment to protecting the workers. Hence, the lack

of holding this regular short safety meeting may increase the accident on site because the reminder about work-related work-space hazards and safe work practices cannot be done. The perception of the supervisors and workers that toolbox meeting or safety meeting is not as important as other work before starting the construction project must be evaded (Choudhry and Zahoor, 2016).

Lack of personal protective equipment (PPE) was the sixth significant factor contributing to the occurrence of accidents on site. Failure to wear personal protective equipment could substantially increase injury risks such as burns, wounds, punctures, electrocution, and falls. Hence, the PPEs such as the right footwear, gloves, clothes, helmet, goggles, and face protection must be provided by the employer to all workers who may be exposed to a risk to their health or safety. Although wearing the PPEs will not be comfortable, the workers should not put themselves in danger by being reluctant to wear them. *Lack of supervision by the supervisor in charge* also contribute highly to accidents' occurrence on site. Supervisors are responsible for a great deal of what goes on day to day in the workplace hence they must duly supervise all the works so that all the site procedures must comply with safety regulations. This finding supported the study by Mishra and Shrestha (2017) who stated that many supervisors, managers and workers are not aware of the health and safety procedures on site and not performing their obligation in ensuring that the workers on the construction site are in good condition in terms of health and safety. The eighth significant factor was *the lack of communication between managers and workers*. Among the most important aspect that ensures safe and smooth project implementation is good and efficient communication between the top management to the site manager, between the manager/supervisor with the workers and also between the contractor to the subcontractors. Nevertheless, a lack of coordination and communication between all the parties may increase the accident risks on site and lead to substandard workmanship (Nawi et al., 2016 and Rahman, 2019). *The attitudes of the workers* ranked ninth significant factor leading to the occurrence of accidents on construction sites. Lack of attentiveness, alertness, carefulness, task-focused and serious attitude by the workers in carrying out the construction works could highly increase the accident risks on site. Besides, many reported in literature stating that workers with bad safety attitudes such as emotional acts, risk-taking, recklessness and selfishness frequently cause accidents on site and fatal occupational injuries.

Conclusion

The current construction industry scenario deteriorates with continuous accidents at the construction site. This study assists the contractor firms in improving the current practice by identifying the contributing factors of the construction accidents. Overall, construction accidents are largely preventable, and contractors should make every effort to ensure that their employees are adequately trained, educated, and protected. This will improve the safety culture among the construction workers by prioritising safety and health in delivering their services. In order to minimise the number of accidents in the construction industry, all parties, including regulators, consultants, contractors, and workers need to be fully committed in ensuring the safety and health at the construction site is implemented accordingly. When construction site workers are hurt in an accident, it affects not just their lives and livelihoods, but also the project progress and the firms' future. However, this study did not encompass the small contractor firms, generally regarded as having poor safety and health records. Additional studies might explore practical ways to minimise construction accidents from other

construction stakeholders' perspectives. The challenges of improving safety and health within these firms are considered for future research. This study contributes to ensuring healthy lives and promoting well-being to construction workers, in-line with the sustainable development goal of good health and well-being.

Corresponding Author

Wan Norizan Wan Ismail

Department of Built Environment and Technology Studies, Faculty of Architecture, Planning and Surveying, Universiti Teknologi MARA Perak Branch, Malaysia

Email: wanno134l@uitm.edu.my

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