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ACCIDENT PREVENTION PRACTICES AT HIGH-RISE BUILDING CONSTRUCTION SITES IN KLANG, MALAYSIA

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ABSTRACT

A construction site is a place of work where there are numerous dangerous activities and accidents. Every year, many incidents occur at building construction sites, particularly high-rise building construction sites. Many unpredictable hazards and accidents lead to thousands of people being hurt or killed each year. The growth of high-rise construction projects has resulted in an increase in the number of fatalities and accidents. The main objectives of this study are to identify the causes of accidents at high-rise building construction sites and to determine the prevention practices for them. A quantitative method was employed in this research.. Data were collected from among professional workers via an online survey in the form of a close-ended questionnaire and randomly distributed to companies in Selangor for the workers to fill in. The sample size of 335 companies was determined using Krejcie and Morgan Table, based on 2637 contractor companies registered in Klang, Selangor. This survey received a 20% response rate equivalent to 66 respondents from 335 questionnaires distributed. There are many causes of accidents at high-rise building construction sites. Fall from height of the building had been ranked as the leading cause, followed by electric shock and being struck by falling objects. As for prevention of high-rise building accidents, proper housekeeping received the support of many respondents to be one of the best prevention practices to avoid accidents, followed by training skills and use of personal protective equipment (PPE). There are many measures that can be taken to prevent accidents at high-rise building construction sites, but the most selected prevention measure is doing proper housekeeping. It is believed that the accident cases can be avoided if all the workers complied with the rules.

Keywords: *causes, accidents, prevention, construction*

INTRODUCTION

A construction site is a place of work where there are numerous dangerous activities and accidents. Due to the rapid development of high-rise buildings, safety and health hazards in the construction industry require additional attention. Every year, a large number of incidents occur on building construction sites, particularly high-rise construction sites. At a construction site, there are many unpredictable hazards and accidents, with thousands of people getting hurt or killed each year. Workers falling from heights and injuries caused by falling objects are the most prevalent causes of accidents on construction sites for high-rise buildings (Goh, 2016).

According to Wahab (2017), construction site accidents occur as a result of either the mistakes of construction companies or the workers. Physical injuries, deaths, losses, and property damage are the usual consequences when accidents happen. Due to such accidents, the construction project may be impacted, financially and timewise as well. These factors might lead to project cost overruns and delays (Asanka and Ranasinghe, 2015).

The National Fire Incident Reporting System (NFIRS) stated that high-rise buildings can be classified into four types which are 7-12 storeys 13-24 storeys, 25-49 storeys, and 50 storeys or more. In general, 75 feet (23 meters) or seven storeys will be the cut-off point for the most purpose.

Based on the statistics of the Social Security Organization (2011), there were 4,937 cases of accidents reported in the construction industry in 2011 and it was the second-highest record of accidents reported among all of the industries. In the same year, there were a total of 9,057 cases of people falling from height and 4,689 cases of people being struck by falling objects. These statistics are considered high when compared to the number of existing workforce in Malaysia.

However, standard procedures taken by construction companies such as implementing safety measures, developing a safety management system and complying with the Occupational Safety and Health Act of 1994 (OSHA 1994) at construction sites can help to reduce or control the accident rate (Idris, 2017).

LITERATURE REVIEW

The Malaysian construction industry plays a vital role in the economic growth of the country. However, on the other side of the coin, the increasing number of fatalities and accident rates on the construction sites are a serious concern, and the statistics are alarming (Manzoor et al., 2021). Construction site work is regarded as one of the riskiest jobs in the nation. Compared to other industries, the rate of accidents in the

construction sector is increasing daily. Many people who work in high-rise building construction sites are hurt, killed, or otherwise harmed every year as a result of accidents. Additionally, there are a lot of hazards associated with construction projects which lead to the occurrence of accidents. Manzoor et al. (2021) highlighted that a majority of advanced countries attempt to reduce the damages and losses brought on by accidents in construction projects by taking appropriate mitigation measures, but developing nations are more frequently victims of construction accidents because they lack safety regulations and are not aware of the safety issues. Due to the shrinking amount of useable land in Malaysia, the demand for high-rise construction projects is still increasing. Accidents and fatalities have gone up as a result of the rapid expansion of high-rise building projects. Therefore, a majority of construction projects result in hazardous situations that might lead to accidents and subsequently influence the safety performance of construction projects. The establishment of a safety management system by construction organisations is necessary to reduce accident rates. Sofwan et al. (2016) stated that the life cycle of a construction project is becoming more dynamic and complex, and as a result, it is classified as a dangerous or extremely hazardous business. The different divisions engaged during the various stages of construction projects contribute to the nature of the construction industry. It necessitates the coordination of numerous interdependent contractors, subcontractors, and activities that could elevate the danger of accidents. The third-leading cause of occupational accidents in Malaysia is the construction industry. High-rise building construction site was identified as one of the riskiest workplaces according to the statistics collected on occupational accidents. The Department of Occupational Safety and Health (DOSH) reports that among all Malaysian industries, construction has recorded the greatest rate of fatal accidents (Idris, 2017). Falling from a height is one of the major types of accidents that cause fatality rates to rise considerably. At any time, from any height, anyone on the construction site runs the risk of falling, especially from the higher levels. Lack of safety precautions on construction sites is one of the many causes of fall accidents. Rey-Merchan et al. (2022) stated that small companies do not have the necessary safety rules and procedures, such as personal fall arrest systems (PFAS) and they are also compromised by malfunctioning safety belts and harnesses, and insufficient or non-existent safety training programs even if they perform small work in any high-rise building.

Causes Of Accidents at High-Rise Buildings

Table 1: Authors Supporting Causes Of Accidents at High-Rise Buildings.

NO	CAUSES OF HIGH RISE BUILDING ACCIDENT	1	2	3	4	5	6	7	8	9	10	TOTAL
1.	Scaffolding	/	/	/	/							4
2.	Fall from height			/	/	/			/		/	5
3.	Struck by falling objects (Plant and Machineries)		/	/			/		/	/	/	6
4.	Fire and Emergency		/					/	/			3
5.	Killed from the explosion								/			1
6.	Dies from electric shock								/	/	/	3

Source: Yadi Li (2018),(2) A.Rahim (2003),(3)Goh (2016),(4)Manzoor (2021),(5) R Arifuddin (2019), (6) T Niskanen (1989), (7) Ommied Hosseini (2021), (8) Rafindadi (2020), (9) SH Jayanth (2015), (10) ARA Hamid (2019)

Table 1 shows the authors that has supported or identified the causes of accidents at high-rise buildings. This table shows that most authors and researchers agree that being struck by falling objects, whether plant or machinery, is the main cause of accidents at high-rise buildings. Next, fall from height might be the second cause of accidents at high-rise buildings as supported by five authors and researchers. Four authors, Yadi LI, A. Rahim, Goh and Manzoor agreed that scaffolding is also among the key causes of accidents at the construction site. Fire and emergency are also among the causes of accidents at high-rise buildings, as supported by the authors A.Rahim, Ommied Hosseini, and Rafindadi. The last one, namely being killed by explosion as a cause of accident in high-rise buildings, is supported by Rafindadi.

Scaffolding

One of the main dangers on building sites has been identified as the scaffolding. A structure called a scaffolding serves the primary function of enabling work to be performed at heights while ensuring the users' safety. Unfortunately, the safety element is often severely neglected, which results in accidents or building disasters that cause fatalities or significant material losses. Despite several regulations outlining the procedures for the installation and usage of scaffolds, the quality of the actual scaffolding structure frequently deviates from the standards. Scaffoldings are

viewed as a secondary structure because of their transient nature; hence, the attention given to them is often insufficient. Risks associated with scaffolding construction on site include things like competent personnel, access, element condition, ties and working platform, guard rail, toe boards, signage, and inspection. Complex-shaped structures demand a customised design strategy. A thorough understanding of the load capacities of the various parts and the operating circumstances of the joints is necessary for proper structure design. Repeated use of the same components in scaffolding leads to their deformation and local damage (Pieńko, 2018).

According to Manzoor (2021), properly functioning and safe scaffolding and ladder has been ranked as the fourth most important safety factor. Poorly made scaffolding construction materials have been implicated for being the cause of accidents. Serious accidents in construction sites have been caused by improper scaffolding erection. Before erecting the scaffolding, personnel must be properly trained in order to avoid failure. In addition, the quality of the scaffolding materials used for construction projects needs to be improved. There are a few causes of scaffolding accidents such as anchor, support, and guardrails. According to Pieńko et al. (2008), the causes of support failure is because ground substrate is often not properly prepared, particularly insufficiently compacted. When the scaffold is positioned on the ground, the compressibility modulus' ratio of minimum value to highest value ranged from 0.1 to 0.75 while the anchor is one of the most crucial components in scaffolding stability. This method of anchoring leads to bending moments in the vertical stands, increasing stress and decreasing structural stability. For guardrails, the risk is when guardrails have not been built properly. However, the recommended assembly approach might lead to a situation that is even more dangerous than when there is no guardrail at all since it gives people a false sense of security. The user believes that the guardrails will prevent him or her from falling in a hazardous scenario. When it comes to internal guardrails, the safety requirements for scaffolding are frequently disregarded.

Falling From Height

Fall from height was placed as the second most common type of accident in high-rise building construction. Previous studies conducted on construction sites identified fall from height as the leading cause of fatalities, followed by getting stuck, hitting objects, and suffering from heart attacks. Everyone on the building site is at risk of falling in at any time and from any height, especially from the higher levels. Fall accidents are caused by a variety of factors, including lack of safety measures on building sites. According to the Department of Occupational Safety and Health (DOSH), construction has the highest record of fatal accident rates among all the industries in Malaysia (Idris, 2017). One of the biggest incidents that significantly raises the fatality rate is falling from a height. According to Zhou and Pang (2012), variables related to people, the environment, materials, equipment, and safety

technology can cause accidents involving falls from great heights. Due to these factors, all parties involved in the construction process should take appropriate measures to prevent fall accidents from heights. Such incidents will have a negative impact on a project's schedule, cost, and quality (Ayob et al., 2018). Lee (2019) said the most significant effects of falling from height include time overruns and damage to the contractor's reputation. Accidents involving falling from height that occur on construction sites will extend a project's timeline and delay its completion. The reputation of the contractor is directly impacted because the contractor will be seen as having poor commitment towards safety and poor safety policies in their projects. The investigations into the incidents that disrupted the schedules of planned activities will also result in a loss of production. According to Nadhim et al. (2016), accidents involving falls from height are significantly influenced by individual factors. Physical features of the construction workers, such as their demography (age, gender, and weight), knowledge level (education and experience), human behaviours and attitudes, physical traits, and health, are partially to blame for causing them to fall (e.g., chronic disease and fatigue). For instance, workers who are obese or overweight, as well as older workers, are more likely to experience weariness, which is a major contributing cause of falls from height. One of the main factors contributing to lifelong damage or death after a fall from a height is the behaviour of the workers (such as negligence, idiocy, poor judgement, or overconfidence). Regardless of their position, level of education, or experience, these behaviours endanger the lives of the employees. Another factor to discuss is site conditions. On the one hand, platform/surface conditions can have a variety of effects on those who work at great heights. Nadhim et al. (2017) also said that when the work area has defects, such as exposed walkways, inadequate guardrails, slippery or sloping surfaces, then incidents of fall from height may happen. Unexpected changes in surface qualities may be enough to cause a fall. In some cases, the environment and the weather have influenced accidents involving falls from great heights. Construction workers encounter humid, cold, rainy, or windy weather locally. Carpenters and roofers are workers who are most exposed to weather conditions. The workers' behaviour must be adjusted to be dependent on the weather because it cannot be changed.

Struck By Machinery

Struck by machinery is the most common type of accident which happens in high-rise building construction sites in Malaysia. Heavy machinery is one of the essential resources for various soil and material handling tasks in the construction industry, significantly contributing to both economic growth and the development of buildings. However, accidents involving heavy machinery can happen, and they frequently have a significant negative impact on the cost and timeliness of a project. People working on construction sites are at risk of being struck by machinery, private vehicles, falling materials, vertically hoisted items, and horizontally moved materials. Accidents can also occur as a result of faulty rigging. Overloading is one of the

elements that might cause cranes to fall during the construction of high-rise buildings. Due to physical contact with powered machinery and the lack of adequate safety and control, heavy machinery can be dangerous and cause serious injuries. Backhoe accidents, rollover accidents, struck-by incidents, malfunctioning machine parts, and electrocution are the main types of accidents involving heavy machinery workers. The amount of permitted crane handling weight is never properly controlled by the supervisor during operation. Accidents can happen due to a variety of causes, including lack of training, inappropriate equipment and working platforms, poor safety attitude, poor housekeeping, failure to utilise personal protective equipment (PPE), and procurement and subcontracting problems. According to J K Bedi et al. (2021), overloading the machinery can result in the structural parts of the machinery failing, which leaves the machinery unable to handle the load. Heavy objects may fall on the operator if the hydraulic jack fails to control the hoist rope's movement or if the crane's hoist rope breaks. Meanwhile, poor waste management can also have a substantial impact due to poor housekeeping and lack of site inspection. Inadequate training of operators in using heavy machinery is another factor that may contribute to accidents. Most of the time, a project's cost is reduced by engaging an incompetent operator for a very low rate. As a result, building projects often have uncertified operators who are ill-equipped in handling equipment in an emergency, and they would not have the competence to take control of the situation. As a result, it is essential to deliver proper safety training in order to equip users with the skills they need to operate equipment safely and effectively.

Fire And Emergency

On all construction sites, fire and emergency situations are shown to be one of the most common hazards. This hazard was described in the prior section as one of the typical dangers that present a significant risk to construction site workers, involving flammable substance storage, and extinguisher suitability. Based on Safelincs's article in 2022, there must be several fires on building sites and in buildings that are having refurbishments. In these incidents, people are hurt or killed, and property is damaged, including priceless historic structures, and the industry is disrupted and hit with unforeseen expenses from which many companies never fully recover. The risk of a fire can be lowered by managing the combustible and ignition hazards in the building. The availability of ignition sources, exits, alarms, awareness, and emergency procedures are also crucial elements. The causes of fire may be electrical faults due to portable and non-portable electrical equipment, hot working including all "processes involving the generation of heat by a naked flame, electrical arc, sparks, and the use of bitumen boilers or grinding,". Next, temporary lighting is installed or specialised task lighting is used to illuminate work areas; the risks associated with this type of illumination are when light units are positioned too close to flammable objects, failing to allow the lamps to cool, broken lamp units with

exposed hot surfaces, and other factors. Lastly, the most dangerous forms of portable heaters should be avoided, and they should only be allowed in situations where they are really necessary. In such cases, portable heaters should be classified as "hot work," and their suitability and placement should be evaluated.

Prevention Practices for Accidents at High-Rise Building Construction Sites

High accident rates in construction are nothing new, but they are not something to be taken lightly. When an accident occurs, it affects not only the injured person, but also the morale of other workers. In addition, handling accidents costs money and slows down construction progress. Accidents result in both direct and indirect costs in addition to negative publicity. Therefore, safety must always be prioritised before time, cost, and quality.

It has been apparent in recent decades that the building industry needs to be more aware of safety. This is because work-related injuries, workers' compensation, insurance premiums, injury-related indirect costs, and litigation are all consequences which are costly. An enormous amount of time is lost each year as a result of workplace-related injuriesand accidents. Accidents on construction sites and health issues are caused by a variety of circumstances. SOCSO reported that more than 80% of Malaysia's construction workers are foreigners with potential for working without authorization or with expired work licences, and that the number of accidents that went unreported may be higher than the number reported. In construction, safety concerns are always viewed as incidental and secondary. Many employers may not realise how expensive it is to deal with any accident until it occurs.

The construction industry is constantly faced with risks. Due to the industry's fragmentation and project-based structure, there is constant change, which necessitates specialised knowledge. The adoption of safety programmes in the construction industry is crucial. Accidents are unwelcome consequences of construction projects which have a number of detrimental effects. They incur additional direct expenses like medical bills and making good of damages, as well as indirect expenses like delays and interruptions, bad reputation, and low morale among workers (Tezel A et al., 2021).

Construction companies must build strategies and action plans to address any potential accidents, as well as make use of the experience gained from lessons learned. Safety hazards have the potential to cause accidents. In order to protect their employees, businesses must improve their safety programmes, evaluate their safety management techniques, and create efficient safety training sessions (Othman et al., 2020).

Othman et al. (2020) assumed that the unique characteristics of the construction sector, such as its labour-intensive and dynamic nature, and exposure to weather

conditions, also play a role in the sector's poor safety record. A safety program is a proactive way to encourage safety on construction sites in such a risky work environment. Since they are the ones who allocate resources to ensure a program's success, top management has a crucial role to play in putting effective safety programmes in place. The execution of a successful safety programme may eventually result in the growth of a positive safety culture.

Durdyev et al. (2017) stated that if factors affecting construction safety performance had been studied, contractors might have acted sooner to promote safety. In a similar vein, Øien et al. (2011) asserted that understanding the causes of accidents beforehand will be useful in preventing serious accidents. These findings consequently increased interest in construction safety (Guo et al. 2016). According to research on the causes of the high rate of injuries and fatalities in the construction business, insufficient training is one of the most significant factors contributing to accidents. In this regard, OSHA has a number of initiatives and programmes aimed at developing a legislative framework to control employee conduct and guarantee workplace safety. These programmes place emphasis on several safety management characteristics, including safety training, which is a crucial aspect of safety management. With the implementation of efficient safety training programmes, the frequency of work-related accidents and fatalities can be decreased. Therefore, it is crucial to identify the key components that would enable trainees and trainers to benefit from a safety programme. It is crucial to pay close attention to how workers feel about safety training in order to pinpoint those aspects. In the context of safety management, effective safety training leads to better field outcomes.

According to Rodrguez-Garzón et al. (2015), training is crucial for enhancing the climate for safety, influencing safety perceptions, and altering safety behaviour in construction projects. Recent research has also shown that safety training can improve personal protective equipment (PPE) use among construction workers The studies also went on to say that training is crucial to reversing construction employees' inaccurate safety views and reinforcing their safety knowledge, such as encouraging them to utilise (PPE as directed. Hasanzadeh et al. (2020) emphasised that improving the level of protective safeguards, such as planning safety training for employees, establishing safety standards, and encouraging the use of PPE, are steps that can reduce human errors.

These measures could potentially prevent injuries, which would lower the overall rate of recorded injuries. According to Reiman et al. (2017), safety training is crucial for developing a variety of learning modalities and influencing people's safety-related behaviour. Man et al. (2019) highlighted the importance of safety training programmes in raising workers' risk perception and reducing risk-taking behaviour. Therefore, the purpose of this study is to identify the elements that contribute to the effectiveness of safety training sessions, which should ultimately result in improved safety performance.

RESEARCH METHODOLOGY

Quantitative methods are used in this study because the quantitative data gets the numbers to prove the broad general points of this research. This study was carried out using a questionnaire via Google Form as the approach to make findings about this case study. A survey in the form of questionnaire was conducted among professional workers. Data were collected via online survey approach based on close-ended questionnaire and randomly distributed to the companies in Selangor for them to fill in.

Analysis On Findings

This chapter will display the result of the survey that has been distributed in the form of a questionnaire to construction companies in Klang, Selangor. Findings include the responses collected from engineers, contractors, quantity surveyors, project managers, site supervisors, safety officers and others. Out of 333 questionnaires distributed this survey received 20% response rate equivalent to responses from 66 respondents. Then, the data obtained were inserted in IBM SPSS for purposes of analysis while illuminating the results. The information gathered was analysed in the form of a table.

Table 2: Ranking of Causes of Accidents in High-Rise Building Construction Sites

	Descriptive Statistics			
No.		N	Mean	Rank
A1.	Fall from height	71	4.58	1
A2.	Dies from electric shock	71	4.32	2
A3.	Struck by falling objects (Plant and Machineries)	71	4.31	3
A4.	Fire and Emergency	71	4.24	4
A5.	Killed from the explosion	71	4.20	5
A6.	Scaffolding	71	4.18	6

Based on the table above, fall from height of the building was recorded as the highest-ranking cause of high-rise building accidents, with a mean value of 4.58. Most of the respondents who answered this survey question agreed that falling from height was the main cause of accidents that occurred at the high-rise building construction site. Since the work involves tall buildings, it will undoubtedly put the laborers at risk of falling from the top floor. There are several factors that cause labourers or workers to fall from the top floor such as not wearing complete PPE equipment, individual's negligence, and site conditions. According to the literature review, a majority of authors agree that fall from height was the main factor or cause of high-rise building accidents, including Goh (2016), Manzoor (2021), Rafindadi (2020), Hamid (2019), Arifuddin (2019), and Nadhim (2019). This further strengthens the findings related to this cause.

Death caused by electric shock ranked second with a mean value of 4.32 based on Table 2 above.The electric shock may be caused by the temporary electrical cables on each floor of the building.. The total support from the authors related to death or injured from electric shock is 3. Death caused by electric shock as the cause of accidents at high-rise buildings construction sites is supported by three authors, namely Rafindadi (2020), Jayanth (2015), and Hamid (2019).

Based on Table 2, being struck by falling objects (plant and machineries) ranked third and has achieved a mean value of 4.31. Contra with support from the authors at the beginning of the study in the literature review. A total of 6 authors supported being struck by falling object as among the main causes of accidents at high-rise building construction sites. According to the findings, two respondents disagreed that being struck by falling objects was a cause of accidents at the high-rise building construction sites. Usually, bruises, fractures, strains, and sprains are the most common types of injuries sustained by workers as a result of being hit by falling objects. Objects fall frequently, from enormous objects like steel beams and roof trusses to little ones like fasteners and small hand tools.

Based on the table above, fire and emergency achieved the mean value 4.21, ranking fourth place in causes of accidents at high-rise building construction sites. Most, but not all, of the respondents agreed that fire and emergency are among the causes of high-rise building construction. In the literature review also, fire and emergency did not receive much support from the authors. This suggests that accidents involving fire and emergency are rare when construction is underway.

Next, according to Table 2, being killed by explosion ranked fifth place among the causes of accidents at high-rise building construction sites, with a mean value of 4.20. This may be because they are not involved with big projects where large explosions are used to build a new building. In the literature review, being killed by explosion also did not get top ranking because not many authors supported that it was the main cause of accidents at high-rise building construction sites.

Lastly, scaffolding has been ranked last as one of the causes of accidents at high-rise building construction sites, with a mean value of 4.18 based on the table above. The findings show a few of the respondents gave a neutral answer, possibly because they are less convinced that scaffolding is the main cause of accidents, while another four respondents disagreed that scaffolding was among the main causes of accidents in high-rise building construction sites. The result has placed scaffolding as the last ranked in causes of accidents in high-rise building construction. This outcome is quite different from the literature review as there are several authors such as Yadi LI (2018), A Rahim (2003), Goh (2016), and Manzoor (2021) who strongly supported the claim that scaffolding is the cause of accidents at construction sites, thus placing it at fourth place in causes of accidents at high-rise building construction sites .

Table 3: Prevention Practices in High-Rise Building Construction Sites

	Descriptive Statistics			
No.		N	Mean	Rank
A1.	Proper housekeeping	71	4.48	1
A2.	Training Skills	71	4.46	2
A3.	Personal protective equipment (PPE)	71	4.45	3
A4.	Inspections	71	4.44	4
A5.	Providing more fall protection systems	71	4.37	5

Based on the table above, proper housekeeping received the approval of many respondents as being one of the best prevention practices to avoid high-rise building accidents as it was ranked first, with a mean value of 4.48. On a construction site, housekeeping is the act of maintaining cleanliness and order. Many respondents agree that it is the best way to avoid accidents at the construction site because, as we know, most construction sites are filled with building materials and dangerous tools, hence making it a place prone to accidents while construction of the building is being carried out. In literature review, Ali et al. (2010) agreed that proper housekeeping such as keeping building site clean is a crucial task which can improve overall safety performance and preventing accidents. Keeping the building or construction site clean can help projects get finished faster because there are less distractions caused by what would otherwise be a chaotic situation (Aboagye-Nimo et al., 2017).

Based on the table above, training skills ranked second with a mean value of 4.46. Many agree that training skills can improve the workers' safety at construction sites. As we know, the construction site is one of the most dangerous work venues as there

are many factors that can cause accidents, including falling out of buildings while doing construction work, negligence while working on site, and many more. All the workers need to participate in safety awareness related programs so that they are more aware and sensitive regarding their safety at the construction site. Developers, contractors, and the government should also play an important role in creating awareness of the threat of hazards at construction sites. In the literature review, Samanta et al. (2023) stated that accidents on construction sites might be caused by a lack of training. Workers need to have the ability and sufficient knowledge to identify potential risks and ways to avoid accidents at construction sites.

According to Table 3, among the best prevention practices against accidents at high-rise building construction sites is the use of Personal Protective Equipment (PPE), ranked at third place with a mean value of 4.45. Quite a big number of respondents agree that PPE is the best measure to prevent injuries in construction, while a few of them disagree that it is the best way to protect them from any harm at the construction site. PPE provides protection to workers to prevent or even minimize exposure to any hazard and they must be worn at all times when construction starts. In literature review, Adeyemi et al. asserted that PPE would be able to prevent and reduce the number of accidents that occur at construction sites. Working without any PPE can greatly increase the risk of unfortunate accidents occurring.

Based on the table above, inspection achieved a mean value of 4.44, ranking fourth place in prevention practices at high-rise building construction sites. The site supervisor or project manager must provide an inspection checklist covering all things like scaffolds, wiring, hand tools, power tools, and many more. Inspection was ranked second last because a few respondents disagreed and some others were neutral as they were not sure whether inspection can help to reduce the risk of accidents or fatalities. There is no strong evidence that reinforces this position because based on the literature review, no authors supported the fact that performing inspections is a very important measure that can save many lives.

Lastly, providing more fall protection systems was recorded as ranking last in the accident prevention practices at high-rise building construction sites, with a mean value of 4.37 based on table above. There is not much gap between the inspections that ranked fifth on the chart. Although this statement has the potential to occupy the top rank, not many respondents support this statement. Perhaps for them the use of PPE, proper housekeeping, and also training skills are more effective when working on construction sites.

CONCLUSION AND RECOMMENDATIONS

In a nutshell, there are many causes of accidents in high-rise building construction sites. From the findings, the top ranking cause of accidents is fall from height of the building. Although there are many preventive steps of high-rise building construction safety, the most selected prevention measure is doing proper housekeeping. With

the right strategies, it is believed that accident cases can be avoided if all the workers follow the rules. Through this research, a set of questionnaires were distributed to 333 contractor firms that were involved in the construction stage and we received a response rate of 20 percent (%). The data collected were analysed using SPSS descriptive analysis. The conclusion of the overall analysis and results were summarised based on the research objectives.

In terms of recommendations, firstly future research in this area can adopt a larger sample size and not just concentrate on Klang, Selangor. Along with increasing the population, this could help future researchers in getting more accurate answers. An increase in the population will also result in an increase in the study's sample size. The results obtained from multiple samples will be significantly more accurate, which can motivate those involved in construction to raise safety awareness. Future researchers can aim to increase the sample size to 200 target respondents or more, and add on more criteria to improve the level of safety in the construction industry. The next recommendation is on the focus field, where future researchers can change the title and focus on current issues or recent issues regarding accidents at construction sites. It does not need to be limited to the construction sites of high-rise buildings only, but focus can be given to the overall frequent accidents by 2025 to get a more interesting and broad title. Lastly, some adjustments are to be made if the research needs to be reconstructed. A longer time frame can be chosen so that participation throughout the entire research process can be recorded, from the initial concept to dissemination. In theory, many more possible case studies can be enlisted so that there would be a bigger selection to choose from once the study properly commences. In order to convey the crucial early involvement of research partners in the original design phase, case studies from the application stage can be incorporated. Researching fewer case studies could be desirable because it would allow for a more thorough anthropological approach. Even though it would be difficult, trying to sample would be incredibly instructive.

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REFERENCES

Aboagye-Nimo, E., & Emuze, F. (2017). *Construction safety through housekeeping: The Hawthorne effect.* Journal of Construction Project Management and Innovation, 7(2), 2027-2038.

Ali, A. S., Kamaruzzaman, S. N., & Sing, G. C. (2010*). A Study on causes of accident and prevention in Malaysian construction industry*. Journal of Design+ Built, 3(1), 95-104.

Ayob, A., Shaari, A. A., Zaki, M. F. M., & Munaaim, M. A. C. (2018, April). Fatal occupational injuries in the Malaysian construction sector–causes and accidental agents. *In IOP Conference Series: Earth and Environmental Science (Vol. 140, No. 1, p. 012095). IOP Publishing.*

Bedi, J. K., Rahman, R. A., & Din, Z. (2021, February). Heavy Machinery Operators: Necessary Competencies to Reduce Construction Accidents. In *IOP Conference Series: Earth and Environmental Science (Vol. 641, No. 1, p. 012007). IOP Publishing.*

Department of Occupational Safety and Health (DOSH), (2022). Accidents Involved Construction Worker in High Rise Building

Durdyev, S.; Mohamed, S.; Lay, M.L.; Ismail, S. Key factors affecting construction safety performance in developing countries: Evidence from Cambodia. *Constr. Econ. Build. 2017, 17, 48–65.*

Goh, Kai Chen & Goh, Hui Hwang & Omar, Mohd Faizal & Toh, Tien-Choon & Mohd Zin, Abdullah. (2016). Accidents Preventive Practice for High-Rise *Construction. MATEC Web of Conferences. 47.*

H., Adeyemi, S., Adejuyigbe, S., Ismaila, and A., Adekoya. (2015) *"Low back pain assessment application for construction workers"*, Journal of Engineering, Design and Technology, vol. 13, no. 3, pp. 419-434.

Hasanzadeh, S.; De La Garza, J.M.; Geller, E.S. Latent effect of safety interventions. *J. Constr. Eng. Manag*. 2020, 146, 04020033.

Idris, N.(2017). Website Department of Occupational Safety and Health Malaysia

Jeschke, K. C., Kines, P., Rasmussen, L., Andersen, L. P. S., Dyreborg, J., Ajslev, J., ... & Andersen, L. L. (2017). Process evaluation of a Toolbox-training program for construction foremen in Denmark. Safety science, 94, 152-160.

Lee, B. H. C., Chen, J. C., & Fo, K. W. (2018). Accidents in Construction Sites: A Study on the Causes and Preventive Approaches to Mitigate Accident Rate*. Inti Journal.*

Lee, B. H. C., Liaw, Z. Y., & Kong, S. K. (2019). A Study of Fall from Height Accidents in High-rise Building Construction Sites in Selangor. *INTI JOURNAL, 2019(49).*

Man, S.S.; Chan, A.H.S.; Alabdulkarim, S. Quantification of risk perception: Development and validation of the construction worker risk perception (CoWoRP) scale. *J. Saf. Res. 2019, 71, 25–39.*

Manzoor, B., Othman, I., & Waheed, A. (2022). Accidental safety factors and prevention techniques for high-rise building projects–A review*. Ain Shams Engineering Journal, 13(5), 101723.*

Nadhim, E. A., Hon, C., Xia, B., Stewart, I., & Fang, D. (2016). Falls from height in the construction industry: A critical review of the scientific literature. *International journal of environmental research and public health, 13(7), 638*.

National Fire Protection Association (NFPA), High-Rise Building Fires, 2016, *http://www.nfpa.org/News-and-Research/Fire-statistics-and-reports/Fire-statistics/Fires-byhttp://www.nfpa.org/News-and-Research/Fire-statistics-and-reports/Fire-statistics/Fires-by-property-type/High-Rise-Building-Firesproperty-type/High-Rise-Building-Fires.*

Øien, K.; Utne, I.B.; Herrera, I.A. Building Safety indicators: Part 1–Theoretical foundation. *Saf. Sci. 2011, 49, 148–161.*

Oluwatosin, V. (2017). Distinguish between primary sources of data and secondary sources of data.

Oregon Occupational Safety and Health Division, 2002. Developing your safety and health program, Available at: *http://www.cbs.state.or.us/external/osha/pdf/pubs/2293.pdf, Downloaded on 20 August 2019.*

Othman, I., Kamil, M., Sunindijo, R. Y., Alnsour, M., & Kineber, A. F. (2020, April). Critical success factors influencing construction safety program implementation in developing countries. *In Journal of physics: conference series (Vol. 1529, No. 4, p. 042079). IOP Publishing.*

Perecmen, S. (2018) How to Prevent an Accident at Construction Site.

Pieńko, M., Robak, A., Błazik-Borowa, E., & Szer, J. (2018). *Safety conditions analysis of scaffolding on construction sites.* Int. J. Civ. Env. Eng, 12(2), 72-77.

Rafindadi, A. D. U., Napiah, M., Othman, I., Mikić, M., & Al-Ashmori, Y. Y. (2020). *Rate of occurrence of fatal accidents in the Malaysian construction industry after BIM implementation*. International Journal of Engineering and Management Research, e-ISSN, 2250-0758.

Rey-Merchán, M. D. C., López-Arquillos, A., & Soto-Hidalgo, J. M. (2022). *Prevention of falls from heights in construction using an iot system based on fuzzy markup language and JFML*. Applied Sciences, 12(12), 6057.

Rodríguez-Garzón, I.; Lucas-Ruiz, V.; Martínez-Fiestas, M.; Delgado-Padial, *A. Association between perceived risk and training in the construction industry*. J. Constr. Eng. Manag. 2015, 141, 453–468.

Safelincs UK, (2022). Fire Safety on Construction Sites *https://www.safelincs.co.uk/fire-safety-on-construction-sites/*

Samanta, S., & Gochhayat, J. (2023). Critique on occupational safety and health in construction sector: An Indian perspective. *Materials Today: Proceedings, 80, 3016-3021.*

Sekoguchi, S., Shirasaka, T., Ando, H., Ikegami, K., & Ogami, A. Evaluation of the performance of replaceable particulate and powered air-purifying respirators considering non-recommended wearing methods.

Sofwan, N. M., Zaini, A. A., & Mahayuddin, S. A. (2016). Preliminary study on the identification of safety risks factors in the high rise building construction. *Jurnal Teknologi, 78(5-3), 1-6.*

Tezel A, Dobrucali E, Demirkesen S, Kiral IA. Critical Success Factors for Safety

Training in the Construction Industry. Buildings. 2021; 11(4):139. *https://doi.org/10.3390/buildings11040139*

Wahab, N. (2017) Website Department of Occupational Safety and Health Malaysia - Website Department of Occupational Safety and Health Malaysia, DOSH.

Zhou, D., and Pang, Q. (2012). Study on Prevention Measures of Falling Accidents during Construction.

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