

## FACTORS CONTRIBUTE TO ACCIDENTS IN CONSTRUCTION INDUSTRY – CASE STUDY: JOHORE STATE CONSTRUCTION COMPANIES

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### ABSTRACT

Construction industry is highly associated with occupational safety and health (OSH) issues compare to other industries. There are plenty of actions and enforcements taken to control the numbers of accidents in construction industry, yet, the fatal rate in construction industry in Malaysia continuously increase from year 2013 to 2017. The objective of this study aims to identify the critical factors contribute to the accidents towards OSH intervention in construction industry. Johor state contributed 5.7% of Gross Domestic Product (GDP) placed after Wilayah Persekutuan Labuan and Wilayah Persekutuan Kuala Lumpur in 2016; and Johor state construction industry contributed 14.2 percentage share of construction sector placed after Selangor and Wilayah Persekutuan Kuala Lumpur in the same year. Since, the construction industry is one of the contributors to GDP; therefore Johor was selected as the targeted location for this study. The questionnaire survey is used to obtain the information from contractors in order to find out the critical factors contribute to accidents; and the respond rate is 41%. The findings show the top five (5) critical factors out of fourteen (14) factors that contribute to the accidents and fatal rate in construction site. The top five critical factors are: Attitude towards not wearing Personnel Protective Equipment (PPE) scored mean of 3.95, Lack of safety knowledge and training, Failure to follow safety procedures during operation (scored mean of 3.74 respectively), Failure to recognize safety hazards (mean 3.67), Improper site safety inspection (mean 3.59) and Poor working surface condition (mean 3.49). Also, this study shows the relationship between the OSH practices and the level of understanding towards OSH of the contractors' practices in construction industry. There are limitations and recommendation of this study for further research towards OSH in construction industry.

Key words: Occupational Safety and Health (OSH), Accidents, Fatal rate, construction industry

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### INTRODUCTION

The continuously development of the world economy caused the entire economy capacity to be improved and build up a great industry civilization throughout the last century (Li, 2012). In many countries, the construction industry acts as a main driver and associate with other industries to the national economy, where it included a sort of business comprising different participants' involvement (Zhao et al., 2012).

In recent years, Malaysia has successfully transformed from an exporter of raw materials into a diversified economy. Malaysia's economy expanded 4.5% in the fourth quarter of 2016 supported mainly by strong domestic demand and the full-year Gross Domestic Product (GDP) grew 4.2% from a year earlier. Johor state contributed 5.7% of GDP placed after Wilayah Persekutuan Labuan and Wilayah Persekutuan Kuala Lumpur in 2016. Among the five sectors that contributing to the GDP, construction industry grew 7.4% in year 2016; and Johor state construction industry contributed 14.2 percentage share of construction sector placed after Selangor and Wilayah Persekutuan Kuala Lumpur in the same year. Hence, construction industry is one of the major contributors to GDP of Malaysia. According to the Department of Statistics Malaysia (2017), the total value of construction work done in the third quarter 2017 recorded a growth of 8.1% and the expansion of the construction industry was driven by positive growth in all sub-sectors. Civil engineering sub-sector maintained to dominate the performance of value of construction work done with 38.1% share followed by non-residential buildings (29.2%), residential buildings (28.2%) and special trades' services (4.5%).

The ongoing development of the construction sector is increasingly associated with numerous of sustainable development challenges which relating in the three bottom lines issues (Shen et al., 2010). Therefore, actions taken to control and monitor the performance accordingly without increase the sustainable development issues (Teo & Loosemore, 2003). Furthermore, construction industry always dealing with the triangle of cost, time and quality as some researchers suggested that health and safety is one of the success criteria towards project performance where if any incidents occurs, it will cause of financial and construction delay to the projects (Lim & Mohamed, 1999). Thus, occupational safety and health issues are being focus as one of the indicator for construction project success (Alzahrani & Emsley, 2012; Ngacho & Das, 2013). However, construction industry

is still contributing much towards the safety and health issues due to its nature whereby it continuously registers a significant rate of accidents related fatalities which associate with several factors such as human, equipments and workplace. In addition, lack of attention to occupational safety and health issues would cause in irreversible costs that associated with workplace incidents, project delays, revises, loss of reputation of the organization and contractor (Wang et al., 2006).

There have been considerable improvements in occupational safety and health aspect in the construction sector since 1970s that because of the legal measures take places in the practices (Hallowell & Gambatese, 2009). However, construction site are the workplaces that capable of presenting innumerable hazards and danger to the site workers safety and health as the construction activities developed in the site are often place the workers in potentially dangerous situation. According to the Department of Occupational Safety and Health (DOSH), the construction employment statistic complied by construction industry development board (CIDB) shown the construction workers comprise approximately 7.1% of total workforce in Malaysia. Therefore, the attention towards accidents issues in this sector is significant in order to determine the factors and preventive measures to reduce the rate of accidents.

In today's situation, the awareness regards to the occupational safety and health risks by players involve in construction industry is increase; yet, the accidents rate is still considerably higher compare to other industries in spite that the substantial improvements are achieved (Sousa et al., 2015). A case study carried out by Chong and Zin (2010) stated that the responsibilities and obligations of each stakeholder tend to overlap during the occurrence of accidents in construction due to the unclear of provisions and regulation in the construction contracts. There are doubts on small scale companies whether they can earn profit from higher standards of Occupational Safety and Health (OSH) practices due to the high implementation cost (Wilson, 2000). Hence, the cost of implementing of OSH into the organization is always tending to be sacrificed and anxious of chance of prosecution (Bakri et al., 2006). There are several causes of OSH failures namely insufficient safety instruction, inadequate housekeeping and poor attitude, poor of organization culture and behaviour, as well as lack of safety culture on site (Lin & Mills, 2001).

Although there are quite a number of research studies related to the OSH issues in construction industry in Malaysia (Chong & Zin, 2010; Dayang & Gloria, 2011; Saifullah & Ismail, 2012; Zin & Ismail, 2012; Mohammed & Ishak, 2013; Au Yong, 2014; Chong & Low, 2014), the unsatisfactory OSH in construction industry always highlighted as it caused an increase in the accidents and health issues as it is the most dangerous industry with multifaceted processes with plants, equipments and other resources (Saifullah & Ismail, 2012). OSH problems are vital to the project progression as it would affect the quality of work, cost and time and it is a cross-disciplinary area that focuses on the safety and health of workers in construction site. There are several issues associated with OSH namely harmful factors such as chemical, physical and psychological, environmental protection, indoor environment, non-stationary work environment (Hori, 2012). OSH management able to help the organization to save cost such as medical care, sick leave, and extra expenses which related to injury and illness workers (Tappura et al., 2015). Meanwhile, employers have duty and responsibility to make sure that all the employees and public who are affected by the company's actions remain safe (Miller & Haslam, 2009). Among the construction industry players, contractors are the important role in construction stage on site. They are one of the most significant parties to ensure all the safety aspects are comply with the rules and regulations. Contractors' responses to all workers in the construction site clearly understand on the safety and health brief, safety system and plan, safety and health training and program. Besides that, contractors have to make sure all the onsite workers wear the Personnel Protection Equipment (PPE) to protect them.

**ACCIDENT IN CONSTRUCTION SECTOR IN MALAYSIA**

The total number of victims for category of Death (D), Permanent Disability (PD), and Non-Permanent Disability (NPD) by ten (10) sectors in Malaysia investigated by Department of Occupational Safety and Health (DOSH) from year 2010 to October 2017 shows in Table 1. The sectors contribute major accidents reports in Death, Permanent Disability and Non-Permanent Disability are manufacturing, construction, agriculture, forestry, logging and fishing. Unfortunately, construction sector is the major sector remains increased in the number of death and non-permanent disability among all the sectors from year 2010 until October 2017 investigated by DOSH.

**Table 1: Occupational accidents (investigated) for death, permanent disability and non-permanent disability by sectors in Malaysia from year 2010 to October 2017**

Year	2010			2011			2012			2013		
	No. of Victims											
Occupational Sectors	D	P D	NP D	D	PD	NP D	D	PD	NP D	D	PD	NP D
Manufacturing	59	16 2	149 3	45	13 3	1471	40	14 7	1535	58	12 8	1469
Mining & Quarrying	1	1	2	7	0	16	7	3	32	5	0	30
Construction	66	4	50	51	5	43	67	12	98	69	12	83
Agriculture, Forestry, Logging and Fishing	30	18	467	41	12	365	38	26	383	33	14	488
Utility	11	3	34	5	3	45	5	3	86	7	1	100
Transport, Storage & Communication	14	1	16	11	6	39	22	5	68	8	1	84
Wholesale & Retail Trade	0	0	0	1	3	13	4	6	63	5	7	66

Hotel & Restaurant	0	0	25	2	1	7	0	1	14	2	1	19
Financial, Insurance, Real Estate & Business Services	1	1	30	6	0	31	4	3	55	2	1	70
Public Services & Statutory Bodies	3	2	40	7	1	59	4	1	49	2	0	67
No information												

\*D=Death \*PD=Permanent Disability \*NPD=Non-Permanent Disability

Year	2014			2015			2016			Oct-17		
Occupational Sectors	No. of Victims											
	D	PD	NP D	D	PD	NP D	D	P D	NP D	D	PD	NP D
Manufacturing	45	11	151	46	89	190	59	8	222	46	86	155
Mining & Quarrying	15	4	43	4	3	32	4	1	18	7	1	30
Construction	72	6	94	88	11	138	106	6	135	63	4	110
Agriculture, Forestry, Logging and Fishing	42	9	441	31	9	440	25	9	433	18	9	366
Utility	0	1	69	6	4	86	2	4	69	8	3	67
Transport, Storage & Communication	15	3	84	22	2	107	13	4	136	9	0	58
Wholesale & Retail Trade	6	3	74	3	3	102	2	4	122	5	0	60
Hotel & Restaurant	0	1	56	0	0	62	4	4	91	2	2	77
Financial, Insurance, Real Estate & Business Services	4	5	65	14	0	105	18	5	99	7	2	104
Public Services & Statutory Bodies	5	20	1	0	1	31	6	2	68	4	0	43
No information										37	26	433

\*D=Death \*PD=Permanent Disability \*NPD=Non-Permanent Disability

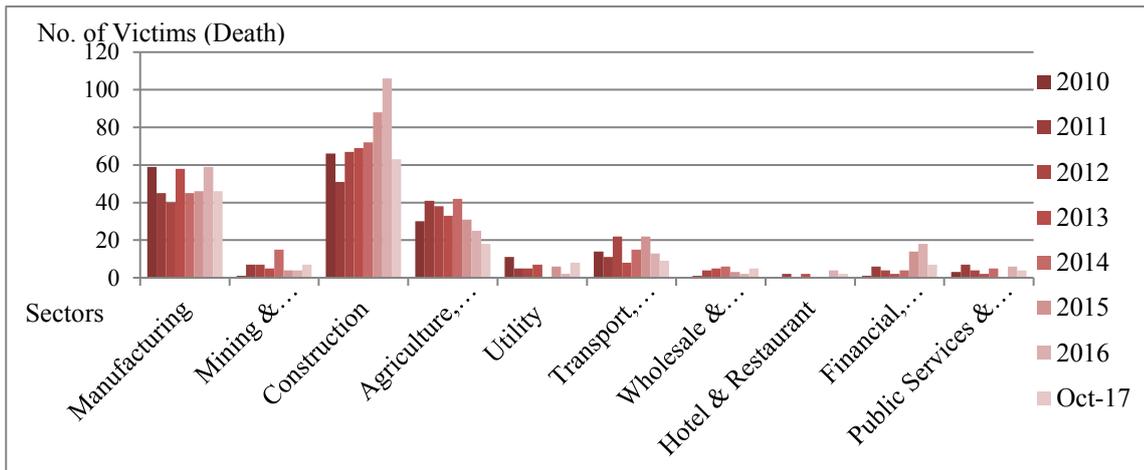
#### OCCUPATIONAL ACCIDENTS FOR CATEGORY OF DEATH IN CONSTRUCTION

The occupational accidents for category of Death by sectors in Malaysia shows in Table 2 and the distribution chart shows in Figure 1. From the accidents statistic investigated by DOSH, construction sector contributed most of the fatal cases throughout the year of 2010 to October 2017. Within the period, the total number of victims seized by construction sector is 582 out of 1569, which is approximately 37% of the total number of victims by all sectors in Malaysia. In 2016, construction sector contributed 106 numbers of victims in death category which is approximately 44.35% of the total number of 239 victims.

**Table 2: Occupational accident for category of death by sectors from 2010 to October 2017 investigated by DOSH**

Year	2010	2011	2012	2013	2014	2015	2016	Oct-2017	Total number of victims (Death) by sectors
<b>Occupational Sectors</b>	<b>No. of Victims (Death)</b>								
Manufacturing	59	45	40	58	45	46	59	46	398
Mining & Quarrying	1	7	7	5	15	4	4	7	50
Construction	66	51	67	69	72	88	106	63	582
Agriculture, Forestry, Logging and Fishing	30	41	38	33	42	31	25	18	258
Utility	11	5	5	7	0	6	2	8	44
Transport, Storage & Communication	14	11	22	8	15	22	13	9	114
Wholesale & Retail Trade	0	1	4	5	6	3	2	5	26
Hotel & Restaurant	0	2	0	2	0	0	4	2	10
Financial, Insurance, Real Estate & Business Services	1	6	4	2	4	14	18	7	56
Public Services & Statutory Bodies	3	7	4	2	5	0	6	4	31
<b>Total Number of victims (Death) in a year</b>	185	176	191	191	204	214	239	169	1569

**Figure 1: Distribution of occupational accident for category of death (D) by sectors from year 2010 to October 2017 investigated by DOSH**



**METHODOLOGY**

The targeted contractors' lists in Johore state obtained from Construction Industry Development Board (CIDB) which determined as the sampling frame. Stratified sampling is used as the sampling method in order to collect the data. This study involves contractors so that it can determine the contractors' practices toward OSH performance in the investigation especially in the size of the company. The questionnaire survey structure design included to determine the respondent's background information; to list out the types of accidents in the company; and the factors contributes to the accidents in construction industry as well as to determine the relationship between company size and the level of understanding of OSH in construction industry.

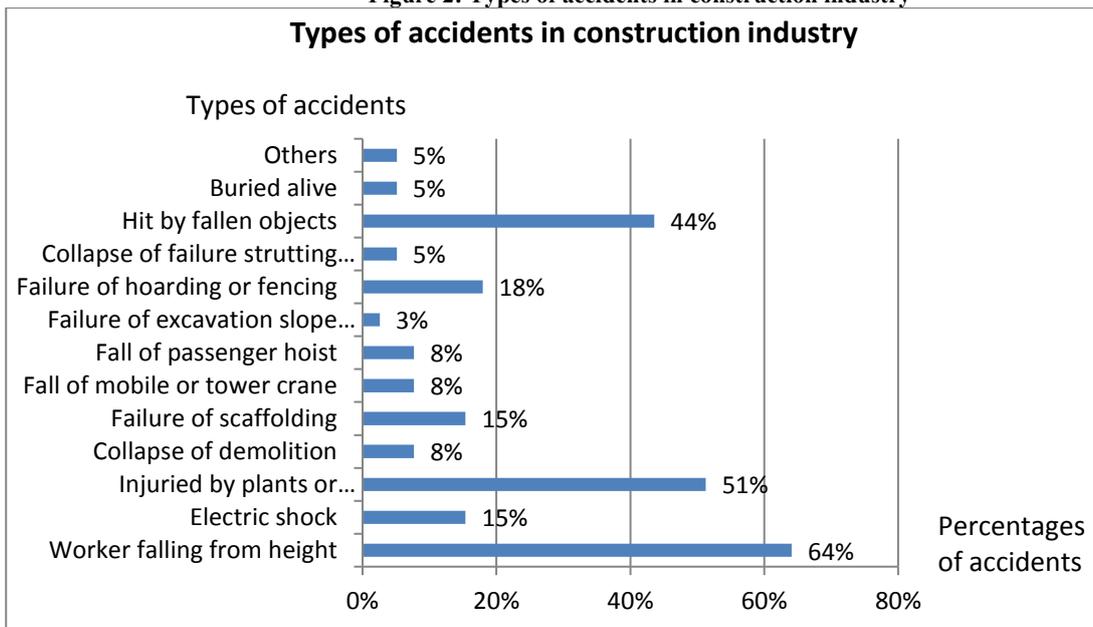
**RESPONSE RATE**

A total of 39 out of 95 survey questionnaires (approximately 41.05%) were received from the main contractors in Johor state. According to researchers, a normal response rate of questionnaire survey in the construction industry was between 20-30% (Takim et al., 2004). Therefore, this response rate is acceptable.

**TYPES OF ACCIDENTS IN CONSTRUCTION INDUSTRY**

This survey also include the types of accidents occur in respondents' companies in order to determine the most frequent accidents in construction industry. Figure 2 below shows the overall types of accidents occurs in construction industry. The highest rate of accidents occur in construction industry is 'Worker falling from height' which is 64% where DOSH statistic stated that the highest rate of accident in construction industry is worker falling from height. The following types of accidents are 'Injured by plants or equipments' (51%), 'Hit by fallen objects' (44%), 'Failure of hoarding or fencing' (18%), 'Failure of scaffolding' (15%) and 'Electric shock' (15%), 'Fall of passenger hoist', 'Fall of mobile or tower crane' share 8% respectively, 'Buried alive', 'Collapse of failure strutting on the excavation' and 'Others' share 5% respectively.

Figure 2: Types of accidents in construction industry



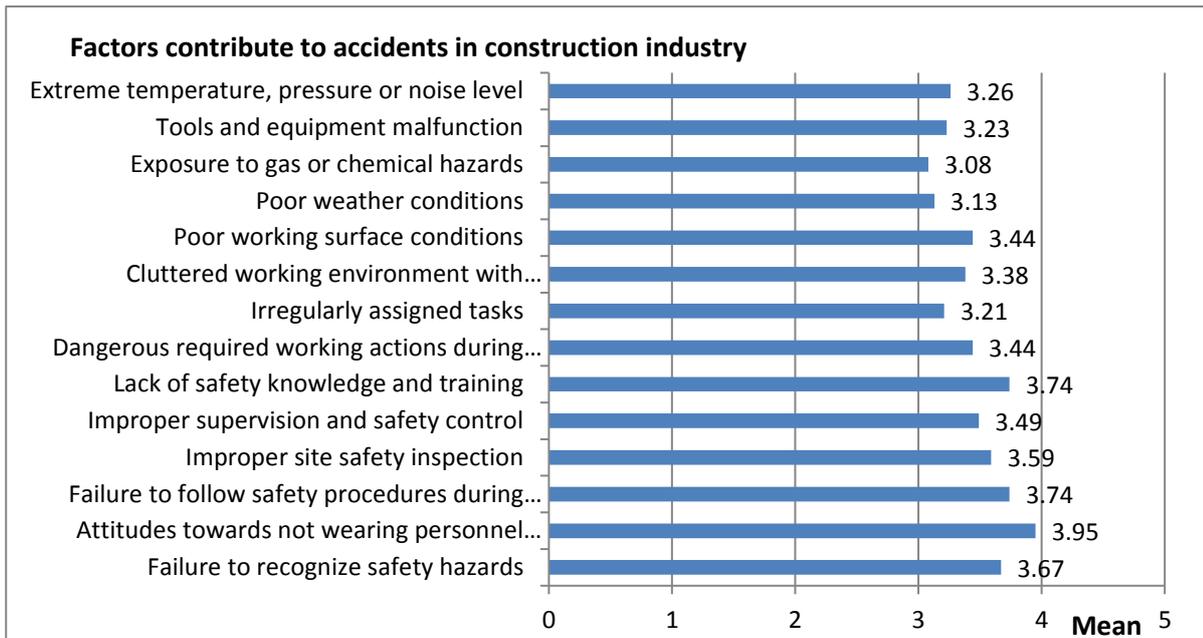
**FACTORS CONTRIBUTE TO ACCIDENTS IN CONSTRUCTION INDUSTRY**

According to Choudhry and Fang (2008), there are several factors contribute to the accidents causes such as ignorance and lack of safety knowledge, failure to pursue safety procedures, the attitude towards safety, do not comply the rules included refuse to wear personnel protective equipment (PPE), work under an unsafe conditions, lack of skill or safety training program, and workers' failure to identify the unsafe condition during work. Besides that, the other factors and event characteristics in accidents causation including inappropriate construction planning, inappropriate construction operation or control, inappropriate construction site conditions, unsuitable ground conditions, unacceptable noise level or crowded environment and the inappropriate operative action (Suraji et al., 2001). The factors contribute to accidents in construction industry that categorized into three major groups, namely 1) Unsafe workers' behaviours: failure to recognize safety hazards; attitudes towards not wearing personnel protective equipment (PPE); failure to follow safety procedures during operation; improper site safety inspection; improper supervision and safety control; and lack of safety knowledge and training. 2) Unsafe working environmental conditions: dangerous required working actions during machine operation; irregularly assigned tasks; cluttered working environment with surrounding objects or structures; and poor working surface conditions. 3) Exposure to hazardous injury sources: poor weather conditions; exposure to gas or chemical hazards; tools and equipment malfunction; and extreme temperature, pressure or noise level. (Suraiji et al., 2001; Huang & Hinze, 2003; Hinze et al., 2005; Mitropoulos et al., 2009).

**Table 3: Factors contribute to accident in construction industry**

<b>Factors Contribute to Accidents in Construction Industry</b>	<b>Mean</b>	<b>Rank</b>
Attitude towards not wearing Personnel Protective Equipment (PPE)	3.95	1
Lack of safety knowledge and training		
Failure to follow safety procedures during operation	3.74	2
Failure to recognize safety hazards	3.74	2
Improper site safety inspection	3.67	3
Improper supervision and safety control	3.59	4
Poor working surface condition	3.49	5
Dangerous required working actions during machine operation	3.44	6
Cluttered working environment with surrounding objects or structures	3.44	6
Extreme temperature, pressure or noise level		
Tools and equipment malfunction	3.38	7
Irregularly assigned tasks		
Poor weather conditions	3.26	8
Exposure to gas or chemical hazards	3.23	9
	3.21	10
	3.13	11
	3.08	12

**Figure 3: Factors contribute to the accidents to construction industry by mean**



The respondents were requested to provide their opinions towards the 5-point Likert scale where 1 = Strongly Disagree, 2 = Disagree, 3 = neither agree nor disagree, 4 = Agree, and 5 = Strongly Agree to determine the opinion according to each questions.

Based on Table 3 and Figure 3 above, there are total fourteen (14) factors fall under three (3) categories are being determined and ranked the critical factors by the respondents throughout this survey, these factors are: Attitude towards not wearing Personnel Protective Equipment (PPE) (rank=1), Failure to follow safety procedures during operation (rank=2), Lack of safety knowledge and training (rank=2), Failure to recognize safety hazards (rank=3), Improper site safety inspection (rank=4), Improper supervision and safety control (rank=5), Dangerous required working actions during machine operation (rank=6), Poor working surface conditions (rank=6), Cluttered working environment with surrounding objects or structures (rank=7), Extreme temperature, pressure or noise level (rank=8), Tools and equipment malfunction (rank=9), Irregularly assigned tasks (rank=10), Poor weather conditions (rank=11) and Exposure to gas or chemical hazards (rank=12).

There are three (3) categories of accidents namely unsafe workers' behaviours, unsafe working (environmental) conditions and exposure to hazardous injury sources. For unsafe worker's behaviours category consists of Attitude towards not wearing Personnel Protective Equipment (PPE) (rank=1), Failure to follow safety procedures during operation (rank=2), Lack of safety knowledge and training (rank=2), Failure to recognize safety hazards (rank=3), Improper site safety inspection (rank=4), Improper supervision and safety control (rank=5). Unsafe working (environmental) conditions category consists of Dangerous required working actions during machine operation (rank=6), Poor working surface conditions (rank=6), Cluttered working environment with surrounding objects or structures (rank=7) and irregularly assigned tasks (rank=10). Exposure to hazardous injury sources category consists of Extreme temperature, pressure or noise level (rank=8), Tools and equipment malfunction (rank=9), Poor weather conditions (rank=11) and Exposure to gas or chemical hazards (rank=12).

The top five (5) factors that contribute to accidents in construction industry are belong to unsafe workers' behaviours category. Among the other factors, the factor of non-wearing Personnel Protective Equipment (PPE) shows the highest rank of non-compliance rate; while this result indicated that Malaysian construction industry often face this attitude of not wearing PPE in construction workers.

Construction workers often ignore the important of wearing PPE during work operation and this is the root cause to accidents. Despite of that, construction workers are lack of safety and health knowledge and training to follow the safety procedures and failed to recognize the safety hazards which will cause the accidents. This might due to attitude towards safety training and the workers might take safety issues for granted where they do not take safety as priority. Construction workers always think that the accidents will not happen on them, hence, the construction workers ignore the importance of wearing PPE and obey the safety work procedures. From the result show in Figure 2, the top three accidents occur in construction industry are 'construction workers fallen from height' which consists of 64%; 'construction workers injured by plants and equipment' with 51%, and 'construction workers hit by fallen objects' consists of 44%. These accidents are happened due to the unsafe workers' behaviours where most of the construction workers' attitude towards not wearing PPE, lack of safety knowledge and training as well as they do not follow the safety works procedures which are the factors that contribute to the accidents in construction industry (O'Toole, 2002; Choudhry and Fang, 2008; Chi & Han, 2013).

Moreover, improper site safety inspection, supervision and safety control by safety officer or safety supervisor also contribute to the accidents in construction industry. According to McDonald and Hrymak (2003), safety and health officers play a very important role to better safety management performance and lead to better safety compliance on site. Hence, safety officer

should consider as part of the safety management system in order to reinforce and play their function in construction industry. With a proper and regular site inspection, the probability of accidents such as construction workers fallen from height, construction workers hit by fallen objects and the workers injured by pants and equipments can be reduced and form a good safety culture in the construction industry (Ghani et al., 2010).

The category of unsafe working condition of construction industry is actually based on different projects and nature to the project surrounding. Therefore, dangerous required working actions during machine operation and poor working surface condition rank at the same place (rank=6) as well as the cluttered working environment with surrounding objects or structures (rank=7) where majority of the respondents involved in several projects which will actually affect the working condition. For instance, during construction of structural stage of projects, the construction workers will associate high risk towards steel structures, tools and equipments and height of the working station which might increase the potential risks in the workplace. Irregularly assigned tasks which rank at 10 where most construction workers will need to be assigned to different tasks due to the variety tasks needed, lack of adequate resources (manpower) in construction industry (Mellor et al., 2011).

The last several factors which are extreme temperature, pressure or noise level, tools and equipment malfunction, poor weather condition and exposure to gas or chemical hazards fall under exposure to hazards category. These factors are normally occurring on specific projects for instance, oil and gas construction and tunnels construction projects which will increase the risks toward construction workers. In this survey, most of the respondents rank these factors lower where careless workers are not the major contributor to accidents; yet, these factors occur due to the management team who do not manage proper on site (Baxendale & Jones, 2000). Thus, the safety management system must closely work with the workers and understand the potential risks to workers who associate with the risks in order to protect workers from hazards.

According to Mohamed (2002), throughout his research on the identification of factors that affecting the safety climate in construction industry are the role of management commitment, communication issue, attitude, involvement and competence of workers, and supervision environment which are able to lead to the safety work behaviour among the workers.

#### **LEVEL OF UNDERSTANDING TOWARDS OSH PRACTICES**

Throughout this survey, majority of the respondents' company do have a clear understanding towards occupational safety and health intervention where most of the respondents' company and their management really pay attention on this occupational safety and health issue towards employees, for instance, 76.92% of respondents' company own a written health and safety policy towards their employees; 71.79% of the respondents' company do keep all the accidents records as future references and 87.18% of respondents' company do carry out health and safety meeting on site in order to ensure the employees safety and health during operation which is also well considered towards the employees' well-being. According to Zin and Ismail (2012), management must take the initial actions to implement a sound OSH management system in order to ensure all the employees who exposure to risks are being protected under the OSH management system. However, there are also a small groups of respondents (12.8%) are not sure whether their company keep any accidents records which maybe they are front-line person and might not have the right to access to information at the top-management level (Mosonda & Smallwood, 2008).

Furthermore, majority of the respondents' company (51.28%) provide health and safety training programmes for all employees where effective safety and health training program is significance to educate employees on several potentials risks and hazards, how to prevent the accidents and how to deal with accidents which related in the workplaces. According to Ghani et al. (2010), training and education programs are playing a very important role in improvement of safety and health awareness in construction industry. However, there are 30.77% of respondents do not carry out safety and health training programs towards employees where insufficiency safety and health training and education among employees are the root cause of accidents in construction sites due to it nature of working environment, where the employees do not have adequate knowledge and skills to realise the potential risks (O'Toole, 2002).

Moreover, top management should take actively actions in leading the organization and employees towards the achievement of safety and health goals by showing the seriousness towards occupational safety and health intervention. In this survey, 53.85% of respondents' company own their in-house or internal safety and health department or committee to show their seriousness towards safety and health issue. The involvement of safety and health representatives on reporting and monitoring, training and education towards the safety issues will actually change the behaviour of the employees (Thye, 2006). However, 38.5% of respondents' company do not own any in-house safety department and 48.7% of respondents' company do not employ external safety consultants or contractors which might due to the budget allocation for safety and health is not adequate. Thus, more financial support from government and stakeholders and provide low cost methods in order to enhance the safety and health intervention into construction industry and the performance of the employees (Wong et al., 2000; Hori, 2012).

#### **RELATIONSHIP BETWEEN COMPANY SIZE AND LEVEL OF UNDERSTANDING OF OSH PRACTICES**

Through the Spearman's Correlation analysis, the results show that, there is a negligible relationship between company sizes with level understanding of OSH in the company; while there is a relationship between keeps all the accidents records at workplace, owning in-house safety and health department and the frequency of safety and health site meeting. Wilson (2000) found that the safety attitudes are varied according to the size of the company. He stated that there is some doubt whether smaller companies can receive benefits from the higher standards of OSH practices due to the implementation costs involved.

**Table 4: Correlation between company sizes and level of understanding the OSH**

Item in Level of Understanding of OSH in the company	P-value		Relationship between Company sizes and level of understanding of OSH
Written HS policy	0.09	$p > 0.05$	no significant
Frequency updating HS policy	0.617	$p > 0.05$	no significant
Provided HS training program to all employees	0.525	$p > 0.05$	no significant
Frequency HS training program	0.381	$p > 0.05$	no significant
Own In-house HS department	0.015*	$p \leq 0.05$	significant
employ out-source HS consultants	0.43	$p > 0.05$	no significant
Keep all accidents records at workplace	0.005*	$P \leq 0.01$	significant
HS meeting at workplace	0.369	$p \leq 0.05$	no significant
Frequency HS meeting at workplace	0.001*	$P \leq 0.01$	significant

Significant Correlation with '\*' meaning the p-value,  $p \leq 0.01$  &  $p \leq 0.05$  are significant relationship among the variables

### LIMITATION AND RECOMMENDATION

This study is focus on the contractors group and their company practices towards occupational safety and health intervention at construction site. This might be not sufficient and not comprehensive where other construction participants such as consultants, architects, developers, clients, government and policy maker might also have different perspectives and provide useful information towards the OSH intervention in construction industry. Furthermore, there is a limit access to the documentation from the respondents' side which might be bias on the overview on this study. For instance, the accidents records are generally private and confidential to the construction companies which might confront to the legal issues.

This study is provided an overview of the construction industry practices towards safety and health issues, where it is also recommended to carry out in other services industries such as manufacturing sector, agriculture sector and transportation sector as future research.

### CONCLUSION

The employers and organizations have the very vital duty and responsibility to ensure all the employees and third parties involved in the construction industry are sound safe in their workplace. In addition, a proper OSH intervention and program are able to help the organizations save costs and sustain the project quality where OSH issues are important to the project process as it would affect the quality of work, cost and time and it is a cross-disciplinary area that focuses on the safety and health of workers. Therefore, this study is significant to understand the interrelationships among the safety risk factors that associated with construction accidents in order to improve the workplace safety by prevention actions in construction industry set by government and policy maker, while by improving and preventing the accidents, it is significant to understanding of risk factors which contributing to the accidents.

In a nutshell, the critical factors contribute to the accidents in construction industry were identified and the results show that there is a negligible significant relationship between company size and the level of understanding towards occupational safety and health intervention in construction industry. However, this study consists of limitations that provide further research towards the occupational safety and health issues in construction industry in Malaysia.

### REFERENCES

- Alzahrani, JI., & Emsley, MW. (2012). The impact of contractors' attributes on construction project success: A post construction evaluation. *International Journal of Project Management* 31, pp 313-322
- Au Yong, H. N. (2014). Safety Culture in Malaysian Workplace: An Analysis of Occupational Accidents. *Health and the Environmental Journal* Vol 5, No. 3, pp 32-43
- Bakri, A., Zin, R., M., Misnan, M., S., & Hakim, A. (2006). Occupational Safety and Health (OSH) Management Systems: Towards Development of Safety and Health Culture. *Proceeding of the 6<sup>th</sup> Asia-Pacific Structural Engineering and Construction Conference (APSEC 2006)*, Kuala Lumpur, Malaysia.
- Baxendale, T., & Jones, O. (2000). Construction design and management safety regulations in practice – progress on implementation. *International Journal of Project Management*, 18, pp 33-40
- Chi, S., & Han, S. (2013). Analyses of systems theory for construction accident prevention with specific reference to OSHA accident reports. *International Journal of Project Management* 31, pp 1027-1041
- Chong, H. Y., & Low, T. S. (2014). Accidents in Malaysian Construction Industry: Statistical Data and Court Cases. *International Journal of Occupational Safety and Ergonomics (JOSE)* Vol 20, No. 3, pp 503-513

- Chong, H. Y., & Zin, R. M. (2010). A case study into the language structure of construction standard form in Malaysia. *International Journal of Project Management* 28, pp 601-608
- Choudhry, R. M., & Fang, D. (2008). Why operatives engage in unsafe work behaviour: investigating factors on construction sites. *Safety Science* 46, pp 566-584
- Department of Statistics Malaysia, 2017. Retrieved from [https://www.dosm.gov.my/v1/index.php?r=column/cthemByCat&cat=77&bul\\_id=NTUvMk5GWwDBaU1tTVNUMlhOWUN5QT09&menu\\_id=OEY5SWtFSVVFVUpmUXEyaHppMVhEdz09](https://www.dosm.gov.my/v1/index.php?r=column/cthemByCat&cat=77&bul_id=NTUvMk5GWwDBaU1tTVNUMlhOWUN5QT09&menu_id=OEY5SWtFSVVFVUpmUXEyaHppMVhEdz09)
- Dayang, N. M., & Gloria, C. M. W. (2011). An Analysis of Accidents Statistics in Malaysian Construction Sector in 2010 International Conference on E-business, Management and Economics IPEDR Vol 3 © IACSIT Press, Hong Kong. 1-4
- Ghani, M. K., Abdul Hamid, Z., Mohd Zain, M. Z., Abdul Rahim, A. H., Mohamad Kamar, K. A., & Abdul Rahman, M. A. (2010). Safety in Malaysian Construction: The Challenges and Initiatives. *Construction Research Institute Malaysia (CREAM), CIDB, Malaysia*
- Hallowell, J. R., & Gambatese, J. A. (2009). Construction safety risk mitigation. *Journal of Construction and Engineering Management*. Vol. 135, pp 1316-1323
- Hinze, J., Huang, X., & Terry, L. (2005). The nature of struck-by accidents. *Journal of Construction Engineering and Management* 131, pp 262-268
- Hori, M. (2012). The Trend Issues of Occupational Safety and Health in Japan. *Procedia Engineering* 43, pp 610-614
- Huang, X., & Hinze, J. (2003). Analysis of construction worker fall accidents. *Journal of Construction Engineering and Management* 129, pp 262-271
- Li, W.B. (2012). Study on the Relationship between Corporate Social Responsibility and Corporate International Competitiveness. *Energy Procedia* 17, pp 567-572
- Lim, C.S., & Mohamed, M.Z., (1999). Criteria of project success: an exploratory re-examination. *International Journal of Project Management* 17 (4), pp 243-248
- Lin, J., & Mills, A. (2001). Measuring the Occupational Health and Safety Performance of Construction Companies in Australia. *Facilities*, Vol. 19, pp 131-138
- McDonald, N., & Hrymak, V. (2003). Safety Behaviour in the Construction Sector, *Report of Health and Safety Authority, Dublin & the Health and Safety Executive, Northern Ireland*, pp 1-82
- Mellor, N., Mackay, C., Packham, C., Jones, R., Palferman, D., Webster, S., & Kelly, P. (2011). 'Management Standards' and work-related stress in Great Britain: Progress on their implementation. *Safety Science*. 49, pp 1040-1046
- Miller, P., & Haslam, C. (2009). Why employers spend money on employee health: interviews with occupational health and safety professional from British Industry. *Safety Science*. 47, pp 163-169
- Mitropoulos, P., Cupido, G., & Namboodiri, M. (2009). Cognitive approach to construction safety: task demand-capability model. *Journal of Construction Engineering and Management* 135, pp 881-889
- Mohamed, S. (2002). Safety climate in construction site environments. *Journal of Construction Engineering and Management*. 128, pp 375-384
- Mohammed, Y. D., & Ishak, M. B. (2013). A Study of Fatal and Non-Fatal Accidents in Construction Sector. *Malaysia Journal of Civil Engineering* 25, pp 106-118
- Mosonda, I., & Smallwood, J. (2008). Health and safety (H&S) awareness and implementation in Botswana's construction industry. *Journal of Engineering, Design and Technology*. Vol. 6, pp 81-90
- Ngacho, C., & Das, D. (2013). A performance evaluation framework of development projects: An empirical study of Constituency Development Fund (CPF) construction projects in Kenya. *International Journal of Project Management* 32, pp 492-507
- O'Toole, M. (2002). The Relationship between Employees' Perceptions of Safety and Organizational Culture. *Journal of Safety Research*, 33, pp 231-24
- Saifullah, N. M., & Ismail, F. (2012). Integration of Occupational Safety and Health during Pre-construction Stage in Malaysia. Asia Pacific International Conference on Environmental-Behaviour Studies, Salamis Bay Conti Resort Hotel, Famagusta, North Cyprus, 7-9 December 2011. *Social and Behavioral Science* 35, pp 603-610
- Shen, L.Y., Tam, V.W.Y., Tam, L. & Ji, Y.B. (2010). Project feasibility study: the key to successful implementation of sustainable and socially responsible construction management practice. *Journal of Cleaner Production* 18 (3), pp 254-259
- Sousa, V., Almeida, N. M., & Dias, L., A. (2015). Risk-based management of occupational safety and health in the construction industry-Part 2: Quantitative model. *Journal of Safety Science*
- Suraji, A., Duff, A. R., & Peckitt, S. J. (2001). Development of causal model of construction accident causation. *Journal of Construction Engineering and Management* 127, pp 337-344
- Takim, R., Akintoye, A., & Kelly, J. (2004). 'Analysis of performance measurement in the Malaysian construction industry', in Ogunlana, S.O., Chareonngam, C., Herabet, P. and Hadikusumo, B.H.W. (Eds), *Proceeding of Globalization and Construction, AIT Conference Centre, Bangkok, CIB, Rotterdam*, pp 533-546
- Tappura, S., Sienvanen, M., Heikkila, J., Jussila, A., & Nenonen, N. (2015). A management accounting perspective on safety. *Safety Science* 71, pp 151-159
- Teo, M., & Loosemore, M. (2003). Changing the environmental culture of the construction industry. In: Molenaar, K.R., Chinowsky, P.s. (Eds.), *Construction Research Congress*, Honolulu, Hawaii, USA, pp 19-21
- Thye, L. L. (2006). Leadership and the Development of OSH Culture. *Proceeding of the 9<sup>th</sup> Conference and Exhibition on National Institute of Occupation Safety and Health (NIOSH), Malaysia*.
- Wang, W. C., Liu, J. J., & Chou, S. C. (2006). Simulation-based safety evaluation model integrated with network schedule. *Automation in Construction* 15, pp 341-354
- Wilson, J. (2000). Safety Management: problems encountered and recommended solutions. *Journal of Construction Engineering and Management*, Vol. 126 No.1, pp 77-9

- Wong, F. K. W., Chan, S. C. M., Tse, R. Y. C., & Love, P. E. D. (2000). Improving Safety Knowledge Through Training – The Case of Hong Kong. *Journal of Safety Research*, Vol. 33, pp 259-276
- Zhao, Z. Y., Zhao, X.J., Davidson, K., & Zuo, J. (2012). A corporate social responsibility indicator system for construction enterprises. *Journal of Cleaner Production*, 29-30, pp 277-289
- Zin, S. M., & Ismail, F. (2012). Employers' Behavioural Safety Compliance Factors toward Occupational, Safety and Health Improvement in Construction Industry. ASEAN Conference on Environment-Behaviour Studies, Savoy Homann Bidakara Bandung Hotel, Bandung, Indonesia, 15-17 June 2011. *Procedia- Social and Behavioural Sciences* 36, pp 742-751