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## HAZARDS AT CONSTRUCTION SITES

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**Abstract.** *Statistic has shown that the number of fatality and permanent disablement cases due to accident at the Malaysia construction sites is one of the highest as compared to the other sector. Even though the number of industrial accidents decreasing but the benefits paid to the accidents victims are ever increasing. Hence, there is an urgent need to mitigate this problem. There are three basic steps that should be taken namely identifying the hazard, assessing the risk and controlling the risk to ensure a safe and conducive working condition. Implementation of effective hazards control methods may require different approaches due to changing of working environment at the construction sites. Latest technology employed at site had wiped out traditional method of construction and consequently introduce new types of hazard to the industry. Therefore, this paper is intended to identify and highlights the hazards that are most commonly found at our construction sites today. The data collection was being carried out through site investigation using a structured questionnaires forms regarding hazards in construction. The sites vary from infrastructure works, high rise building, housing development, industry building and institutional building. The study determine twelve (12) major groups of hazards in relation to works at construction sites such as power access equipment, ladder, roof work, manual handling, plant and machinery, excavation, fire and emergency, hazardous substances, noise, protective clothing and protection to public. The study was conducted on 140 construction sites and the results showed that the most common hazards for the project around the study area are associated with the protective clothing, noise and fire and emergency.*

## **1. Introduction**

The construction industry is currently being recognized as a major economic force in Malaysia. It is also one of the most hazardous industry. Based on the Social Security Organization (SOCSO) report in 2000, the fatality rate in the construction industry in Malaysia was of more than 3 times of all workplaces. Whereas, compensation costs paid out by SOCSO for industrial accidents and diseases accounted for almost RM650 Million[1]. As the hidden or indirect cost of an accident is eight to 33 times more than direct costs, the total cost of accident can run into billions of ringgit.

In the field of occupational safety and health, Malaysia is now moving away from the traditional approach whereby it is believed that all occupational hazards can be controlled through detailed regulations. On 25<sup>th</sup> February 1994, Occupational Safety and Health Act 1994 (OSHA) came in force providing protection on safety and health for work activities in all economic sectors including public services and statutory authorities, except those subjected to Merchant Shipping Ordinance and the armed forces [2]. Under Section 15 (1) and (2) Occupational Safety and Health Act 1994, employers have a duty to ensure, as far as practicable, that employees are not exposed to any hazard at the workplace [2].

Even though there has been a marked reduction in the number of industrial accidents and the rate of accidents per 1,000 workers since the introduction of the OSHA 1994, there has not been a credible improvement over the last five years. The rate per 1,000 workers has been at a plateau of 9.5 to 10.5 persons, while for developed nations, it is three to four persons per 1,000 workers[1]. Even though regulations on occupational safety and health in Malaysia are quite comprehensive, the level of awareness and practicability of such regulations within the society of construction industry are generally lower than what supposed to come in force.

There is a popular belief that the construction site is unsafe and the risks that the workers are subjected to are usual. The accidents happen may cause physical injuries or health illness in long term. The term hazard in this study is defined as anything that can cause harm such as scaffold, excavation, roof work, working from ladders and etc.

There are two major categories of hazard in construction sites namely: -

- i. the risk of physical injury or physical injury hazard  
The agents to the above mention hazard are normally associated with process of works or equipment used and climatic conditions such as scaffolds, power access equipment and manual handling, ladder, roof work, plant and machinery, excavation, etc [3].
- ii. the risk of ill health or health hazard  
Health hazards in construction work may be grouped under chemical, physical and biological hazards[4].

Hazard that has risk of physical injury can cause direct injury to our worker at site and if severe can cause death. However, hazard that has risk of ill health can only be notified after long term of period and shall cause sickness or death after certain period of time [5]. In order to ensure a safe and conducive working condition there are three basic steps that should be taken namely identifying the hazard, assessing the risk and controlling the risk.

Therefore, this study was performed in order to identify and highlight the type of hazards that are most commonly found at construction sites in Malaysia.

## **2. Study Methodology**

### **2.1 Data Collection**

Data collection is the utmost important stage in this study in order to achieve the desired objectives within the scope of work. Substantial data for this project paper was obtained through structured checklist. Checklist was design to assist in the investigation during the site visit to the construction sites within several states in Malaysia. Types of site being investigated are mainly infrastructure works, housing development, high-rise building, industry building and institutional building. Other parameter like cost of the project, project duration and number of worker at sites are also being identified to determine the significant of each parameter to the types of hazards being identified.

### **2.2 Checklist Design**

The checklist was structured in three (3) sections.

- Section A capture the background data of the respondents such as gender, age, position, employment and experiences.
- Section B require the respondents to evaluate the significant of the hazards found in the work place environment whereas section C require the respondents to evaluate the significant of the specified hazards found in the construction sites. The significant of the hazards is scale from 1 to 4. The score of 1 demarcate “unacceptable”, 2 as “acceptable with major changes”, 3 as “acceptable with minor changes” and 4 as “acceptable”. Table 1 shows the ranking criteria from 1 to 4.

*Table 1* Ranking criteria

<b>Rank</b>	<b>Definition</b>
4	Original specification or statutory regulatory are met or satisfied.
3	Additional work required to satisfy specification
2	Extensive work required to satisfy specification
1	No way to satisfy specification or acceptable variation of it.

### 2.3 Size Of Sample

The checklist are assessed during the site visit to 140 construction sites around Klang Valley, Selangor, Perak, Penang, Kedah, Negeri Sembilan, Pahang and Terengganu area. The types of works involve are infrastructure works (15 sites), housing development (45 sites), high-rise building (45 sites), industry building (15 sites) and institutional building (20 sites).

### 2.4 Analysis Of Data

The identification process for most common hazards was evaluated from the checklist assessed during site visit as follows:-

1. The frequency for each group of hazard was determined. The highest frequency obtained for any of the hazards identified shall be concluded as the most common hazards.
2. The score for each of the criteria of assessment for each individual hazards identified should be sum up.
3. The score obtained shall be averaged out with the frequency to obtain the ranking of the hazards.

### 2.5 Limitation Of Study

The sample only represent the localized scenario. The hazards identified correspond to the work in progress at the time of the survey being performed.

## **3. Result and discussion**

This section discusses the findings based on the results from the data collected through structured checklist during site visit. The discussion of the findings is based on the ranking of rating through responses ranging from 1 to 4 and the total scoring point accumulated. For the purpose of discussion only the first three of the most cited hazards which receive the lowest score are discussed as the main findings.

### 3.1 Work Place Environment

Checklist for work place environment cover item such as access, guard rail, condition of opening, temporary structures, site tidiness, waste disposal and visibility. From the survey it can be concluded that the following items require a lot of improvement: -

1. Condition of holes and opening still require proper guard rail to prevent falls. These environment criteria were ranked 2 and score 300 which are the lowest score.
2. Site tidiness was ranked 2 and this means that it still require a lot of improvement due to second lowest point obtained with 315 point.
3. Arrangement for collecting and disposing of waste material still lacking was rank 2 with 325 point which require attention and action.

### 3.2 Common Hazards At Construction Sites

Twelve (12) types of main hazards were identified through the literature review namely scaffold, power access equipment, ladder, roof work, manual handling, plant and machinery, excavation, fire and emergency, hazardous substances, noise, protective clothing and protecting the public

The results of analysis generally shown that construction sites within the study area have a common hazards that are not being well taken care of which had a high exposure to the workers at sites such as: -

1. Protective clothing was ranked 2 which demarcate that extensive works or effort require to achieve the satisfactory specification. Frequency of this hazard is very high which is 134 out of 140 sites.
2. Noise was also ranked 2 with frequency 134 out of 140 sites.
3. Fire and emergency hazards was ranked 2 as well but with a frequency 118 out of 140 sites.

### 3.3 Hazards For Construction Sites Based On Type Of Works Involved

The type of works involved at sites has a relation to the type of hazards expose to the workers. Further analysis shown below are the type of hazards associated with the type of works involved.

#### 3.3.1 Hazards at Construction Sites Involve In Infrastructure Works

Hazards which were identified as a general hazard in previous section are not included in this section to avoid repetitive conclusion. The analysis of the data collected through site visit had indicated the following hazards at infrastructure works sites to be the most common around the study area: -

1. Excavation was ranked 2 with a high frequency of 15 out of 15 sites.
2. Ladder was ranked 2 with frequency of 15 out of 15 sites.
3. Plant and machinery was ranked 3 with frequency 15 out of 15 sites.

### *3.3.2 Hazards at Construction Sites Involve In Housing Development*

From the analysis carry out, hazards at site involve with housing development are identify to be as follow: -

1. Roof work was ranked 2 with frequency 40 out of 45 sites.
2. Ladder was ranked 3 with frequency of 45 out of 45 sites.
3. Manual handling was ranked 3 as well with frequency 40 out of 45 sites.

### *3.3.3 Hazards at Construction Sites Involve In High Rise Buildings*

From the analysis carry out, hazards at site involve with high rise building construction are identify to be as follow: -

1. Scaffold was ranked 2 with a frequency 45 out of 45 sites
2. Ladder was ranked 3 with frequency of 45 out of 45 sites.
3. Power access equipment was ranked 3 as well with frequency of 35 out of 45 sites.

### *3.3.4 Hazards at Construction Sites Involve In Industry Buildings*

From the analysis carry out, hazards at site involve with industry building are identify to be as follow: -

1. Roof work was ranked 2 with frequency 13 out of 15 sites.
2. Scaffold was ranked 3 with frequency 15 out of 15 sites.
3. Plant and machinery and manual handling were ranked 3 with frequency of 14 out of 15 sites.

### *3.3.5 Hazards at Construction Sites Involve In Institutional Building*

From the analysis carry out, hazards at site involve with institutional building development are identify to be as follow: -

1. Roof work was ranked 2 with frequency 15 out of 20 sites.
2. Ladder was ranked 3 with frequency of 20 out of 20 sites.
3. Scaffold was ranked 3 as well with frequency 18 out of 20 sites.

## **3.4 Type Of Hazards That Required Additional Attention**

Each hazards associated with the twelve(12) category of hazards are further analysed and the result are discussed below.

### *3.4.1 Scaffold*

Scaffold was identified as one of the main hazards in construction sites. Checklist of hazards regarding scaffold works at site include items such as competence person, access, condition of elements, ties and working platform, guard rail, toe boards, signage and inspection. Among the items that require attention are: -

1. Additional precaution condition i.e. intermediate guard rails are still lacking and only received 156 scores which are the lowest among all other hazard in scaffolds.
2. Barrier or warning notices are most of time unavailable or insufficient to warn people using the incomplete scaffold received 170 scores.
3. Insufficient or never conducted the periodical inspection of the scaffold. The score obtained for this hazard is 190.

However, item for condition of scaffold that secured to the building or structure to prevent collapse for most of the sites visited was quite satisfactory with the score of 254 (highest score).

### *3.4.2 Power Access Equipment*

Hazard in association with power access equipment identified include competence person, skill of operator, equipment security, guard rail, barrier and power supply. Item such as precaution taken to prevent people being struck is being identified to be having the lowest score of 70. However, overall ranking for power access equipment still satisfactory with rank 3 that demarcate additional works still require to satisfy original specification.

### *3.4.3 Ladder*

Hazard in association with ladder include item such as ladder condition, position and foundation, suitability and prevention to slipping sideways. The condition of all ladders receive the lowest score with 336. The other hazard identified was the prevention of ladder to slip sideways or outward with 380 points. However, overall ranking for ladder still satisfactory with rank 3.

### *3.4.4 Roof Works*

When dealing with roof works, precaution to exclude people from area below roof works and other additional precautions to stop debris falling onto them were the lowest score among all with 136. It is followed by barriers and guard rail or cover to provide people pass or work near fragile material or etc with second lowest score,

156. Overall ranking of roof works are 2 due to extensive works required to satisfy the safety regulation for the said works at sites.

#### *3.4.5 Manual Handling*

Hazard in association with manual handling was identified as risk of injuries due to manual handling. It is being identified to be having the lowest score with 336. However, overall ranking for manual handling still satisfactory with rank 3 that demarcate additional works still require to satisfy original specification.

#### *3.4.6 Plant And Machinery*

Most of the hazards in association with plant and machinery were identified to be more significant at site involve in infrastructure works and industry building. However, overall rank for these groups of hazards are quite satisfactory with overall ranking of 3 which demarcate only additional works required to satisfy the specification. Hazards that need to take note by all community at sites in association to plant and machinery shall be condition of guards for any dangerous part and the precaution on the dangerous part.

#### *3.4.7 Excavation*

Excavation was identified to be the major hazards in construction sites involve with infrastructure works. For other sites, the excavation had already completed at the time of survey. Among the items survey are method and adequacy of support for excavation, slope, access, guard, barrier, signage and spoil. From the analysis, the following hazards in association with excavation are identified to be the most significant for infrastructure works at sites in chronological order: -

1. Unavailability of insufficient stop block or signage to prevent or warn tipping vehicle falling in with score of 30.
2. Inadequate guard rail to prevent people falling in with score of 35.
3. Edge of excavation stored with material, plant, etc with 45 scores.

#### *3.4.8 Fire And Emergency*

Fire and emergency was detected as one of the most common hazards in all construction sites. In the earlier part, we had defined this hazard to be one of the common hazards that had great exposure to the workers at construction sites. Among the items survey are storage for flammable substances, suitability and availability for extinguisher, ignition sources, exit, alarm, awareness and emergency procedure. From the analysis, the following hazards associated with fire and emergency at sites are identified in chronological order from lowest score to the highest: -



1. Emergency procedure of evacuating during fire alarm was detected to be the lowest score with 224 scores and rank 1 which demarcate no way to satisfy the original specification. During the sites visit, it was realized that majority of the project sites do not have any evacuating procedure during fire alarm.
2. Regarding the awareness of emergency procedures by workers at sites, it had scored 252 scores which are the second lowest in the checklist of fire and emergency and rank 1 as well. Most of the sites had a total ignorance to the importance of procedure during fire alarm not even by the workers at sites but the upper management as well.

#### *3.4.9 Hazardous Substances*

Hazard related to hazardous substances was identified having the lowest score with 420 as protective equipment used in handling the substances. However, overall ranking for hazardous substances still satisfactory with rank 3.

#### *3.4.10 Noise*

Hazard associated with the noise was identified to be the appropriateness of hearing protection used by worker which receive the lowest score with 168 and rank 2 which demarcate that extensive works require to achieve or meet the specification.

#### *3.4.11 Protective Clothing*

Hazard regarding the protective clothing was identified to be the attitude of workers toward using this equipment which score the lowest with 308 and rank 2. Other items surveyed were the supply and condition of the personnel protective equipment.

#### *3.4.12 Protecting The Public*

For protection to the public, signage to warn public was detected to be the lowest scores which had obtained 350 scores and rank 3. Overall ranking for this hazard was still satisfactory with rank 3.

### **4. Conclusion**

Within the scope of the study the following conclusion can be made:-

#### **i. Work Place Environment**

Within the area of the scope of project regarding site environment (in chronological order) the following items would require a great attention for our safety practitioners due to the lowest scores obtained ; -

1. Condition of holes and opening to prevent fall
2. Site tidiness
3. Arrangement for debris collection

ii. Common Hazards At Construction Sites

It can be concluded that in general for most of the project sites around the study area had a common hazards as follows (in chronological order from highest frequency to lowest);

1. Protective clothing
2. Noise
3. Fire and emergency

It was observed that most of the project site workers within the scope of study had a low level of awareness toward using the personal protective equipment. Even for the employer, the supply for this equipment is seen to be quite inadequate compare to the quantity of workers at sites. This situation still required an enormous improvement to catch up to the acceptable level of safety and health practice at site.

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