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## SAFETY MANAGEMENT ON CONSTRUCTION SITE

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### ABSTRACT

There have been significant reductions in the number and the rate of injury over the last 20 years or more. Nevertheless, construction remains as the one of the high risk industry. The purpose of this study is to examine safety management in the Indian construction industry, as well as to highlight the importance of construction safety management. The industry has contributed significantly to the economic growth of the country. However, when construction safety management is not implemented systematically, accidents will happen and this can affect the economic growth of the country. This study will try to put the safety management in construction project as one of the important elements to project performance and success. The study will focus on construction project in India. The study will also emphasize on awareness and the importance of safety management in construction project.

**Keywords :** Safety management, Construction industry, Awareness and Practicability.

### 1.INTRODUCTION

In developing India on becoming a developed nation by the year 2020, construction industry has been recognized as one of the major economic forces. Unfortunately high rates of accidents and fatalities had tarnished its reputation and image. Globally, the construction industry is still considered as one of the most hazardous industries (Hinze, 2008). Construction safety as a result continues to represent a problem and pose a challenge for researchers and practitioners. In India, both the society and economy have suffered human and financial losses as a result of the poor safety performance in the construction industry. Department of Occupational Safety and Health (DOSH) in India reports that occupational accidents by sector shows that the highest number of death was in the construction industry as of for the 2013 incidents (DOSH, 2013). In a study carried out on Honduras constructions sites, Jaselskis and Suazo (1994) demonstrated a substantial lack of awareness or importance for safety at all levels of the construction industry. Department of Safety and Health (DOSH) have imposed comprehensive safety regulations in the construction industry. However, the level of awareness and practicability of it are generally lower than expected over the last five (5) years (Abdul Hamid et al, 2003). According to Khalid (1996), good safety programs would certainly help in reducing injuries at construction site. It will also minimise construction costs, increase productivity and profitability and more importantly it could save lives of workers. Thus, these will consequently contribute positively to construction industry and nation as a whole. Besides causing delays in operations, accidents also cause directly and indirectly incur costs (Bakri et al, 2006). Therefore as required by the Occupational Safety and Health Act 1994 (OSHA), it is mandatory for all construction companies to provide a Health and Safety Officer for project more than RM20 million.

## 2. PROBLEM STATEMENT

Construction safety management is not implemented systematically in most construction companies. Due to that, accidents in the construction site always been highlighted. In addition to that, statistics from the Social Security Organization (SOCSO) reported that, construction industry has been the fourth highest ranking in the year 2004 in terms of number of fatality cases. Abd Hamid and Abd Majid (2006), concluded in their study on 'Construction Safety Benchmarking' that majority of construction companies surveyed were only at the very beginning stage of safety program implementation. They were not even close to behaving an ultimate safety program driven by a safety culture. This study is the first step in reducing the percentages of accidents in construction site. In addition, this study will lead the reader to know how far is the implementation of the Construction Safety Management in India is being done. Besides that, it also gives an overview about current situation in construction site. Thus, this will reduce the bad impression many people that construction site is a danger workplace.

## 3. OBJECTIVE

The purpose of this study is:

To investigate the factors of improper safety management in construction project.

To investigate the current practices of construction safety management implemented by a construction company in India.

The scope of this study is on safety management in the construction site. This study will try to put the safety management in construction project as one of the important element to project performance and success. The study will focus on construction project in India and a case study will be done at Proposed 40 units 3-Storey Shop Office. The study will also emphasize on awareness and importance of safety management in construction project.

## 4. LITERATURE REVIEW

### 4.1 FACTORS AFFECTING IMPROPER SAFETY MANAGEMENT IN CONSTRUCTION INDUSTRY

#### SAFETY TRAINING

CII (1993) study identifies safety training as one of five high-impacts zero accident technique. Hinze and Wilson (1999) indicate that there is unanimous agreement among the respondents of their study that worker training is vital to improved safety performance.

#### SAFETY INSPECTIONS

Safety inspections are the usual means used to enforce safety at the jobsite. Hinze and Gambatese (2003) indicate that safety inspections are one of the means by which project managers and site supervisors can become acquainted with the nature of the safety conditions on the site. Toole (2002) argues that to effectively enforce safety on jobsite, the entity must be able to monitor the work on a frequent basis. Wong et al. (1999) argue that safety performance is affected by monitoring of safety compliance. Jaseliks et al. (1996) recommend increasing site safety inspections. Their analysis show that firms with better safety performance conducted more site safety inspections compared with firms of poor safety performance.

#### SAFETY INCENTIVE AND PENALTIES

Hinze and Wilson (2000) indicate that incentives have the objective of providing a positive reinforcement of a desired behaviour. Safety incentives are designed to influence worker actions so that safer worker performance is encouraged and rewarded. According to CII (1993), Safety incentives are among the top five high-impacts zero techniques. Hinze and Gambatese (2003) indicate that of the various types of safety initiatives that companies utilize to promote worker safety, the most widely implemented type of program involves safety incentives.

#### COMPLIANCE WITH SAFETY LEGISLATION

In order to improve safety performance, a standard checklist is used to conduct the audit. This checklist included those items which are compliance to Occupational Safety and Health Act and Factories and Machinery Act and perceived to be important from the safety point of view (Shuratman Z. et al., 2007). These are the Occupational Safety and Health management, safety committee, machinery, scaffolding, working at height, public safety, workers quarters, storage facilities, formwork, excavation and shoring, personnel protective equipment, platform, floor opening, edge of open floor, access and egress, electrical safety, cleanliness, health and welfare, piling and demolition.

## LABOUR TURNOVER RATES

To improve safety performance, Harper and Kohen (1998) recommend reducing labour turnover rates. Hinze and Gambatese (2003) examine the relationship between labour turnover rates and safety record. Hinze and Gambatese (2003) study results show that higher turnover rates are associated with higher injury rates. Consequently, construction contractors are advised to decrease their labour turnover in order to improve their safety performance.

## WORKER'S ATTITUDE TOWARDS SAFETY

Aksorn and Hadikusumo (2008) indicate that attitude is a tendency to respond positively and/or negatively to certain persons, objects or situations. Individuals are different in their perception of risks and willingness to the risks. Successful safety programs can be achieved if the positive attitudes of employees towards safety are improved.

## AVAILABILITY OF SAFETY EQUIPMENT

Toole (2002) argues that some construction accidents results because of the absence of safety equipment necessary to perform the job safely at the location of the work. Duncan and Bennett (1991) reviewed the performance of various fall protection systems and concluded that both active measures (those that prevent workers from falling, for example guardrails) and passive measures (those that protect workers after falling, for example, safety nets) are useful in reducing fall injuries. Chi et al. (2005) analysed contributing factors to 621 occupational fatal falls. Significant linkages were found between causes of falls and accident event. Falls associated with lack of complying scaffolds, unguarded openings, and inappropriate protections, removal of protections and improper use of Personal Protective Equipment (PPE). Chi et al. (2005) suggest prevention measures to prevent falls or to mitigate the consequence of falls. The summarized of data collected shown below:

### 4.2 .THE CONSTRUCTION STAKEHOLDER RELATED TO SAFETY

Historically, in April, 1994 the Department of Factory and Machinery (DFM) has been changed to a new name called Department of Occupational Safety and Health (DOSH) as since the newly legislated Occupational safety and Health Act, 1994 complemented the Factories and Machinery Act, 1967. This department is under the jurisdiction of the Ministry of Human Resources. It is responsible for ensuring the occupational safety, health and welfare of people at work as well as protecting other people from the safety and health hazards arising from the activities of various sectors including construction.

The department is a government agency responsible for the administration and enforcement of legislations related to Occupational Safety and Health for our nation, with a vision of becoming the organisation which leads the nation in creating a safe and healthy work culture that contributes towards enhancing the quality of working life. The functions of the department are as follows:

To study and review the policies and legislations of occupational safety and health.

To conduct research and technical analysis on issues related to occupational safety and health at the workplace.

To carry out promotional and publicity programs to employers, workers and the general public to foster and increase the awareness of occupational safety and health.

To become a secretariat for the National Council regarding occupational safety and health. To enforce the following legislations :

Occupational Safety and Health Act 1994 and its regulations.

Factories and Machinery Act 1967 and its regulations.

Part of Petroleum Act 1984 (Safety Measures) and its regulations.

Efforts to increase awareness of employers, employees and the general public on the need for a safe workplace with no health hazards require diligent efforts and the participation of numerous parties. Different approaches are required for the implementation of these efforts, and they should be carried out in an integrated, comprehensive and continuous manner in order for maximum effectiveness. This also assures all parties involved that OSH is indeed an important issue towards ensuring a quality working life as well as the survival of employers in any business transaction. As such, all allocated expenditures and efforts to ensure the success of the OSH program and its management system should be regarded as an investment.

To accomplish the assigned responsibility, the department performs three important activities: the formulation of standards, enforcement, as well as promotion and communication activities. The departmental organisation structure consists of its head office and 13 state offices. The scope of duties for the former focus on the formulation of standards, approval, accreditation and data analysis; whilst the latter concentrate more on enforcement of acts and regulations, inspection, audit, legal proceedings and investigations.

### 4.3 NATIONAL INSTITUTE OF OCCUPATIONAL SAFETY AND HEALTH (NIOSH)

The National Institute of Occupational Safety and Health (NIOSH) was officially established in December, 1992 as a Company Limited by Guarantee, under the Indian Companies Act, 1965. The main vision of this institute is to be the 'Leading Centre of Excellence' in Occupational Safety and Health. NIOSH's function is to provide training, consultation services, disseminate information and conduct research and development to employees, employers and those responsible, either directly or indirectly in the field of occupational safety and health. As stated in the Memorandum and Articles of Association, NIOSH aims to:-

Contribute towards efforts in upgrading Occupational Safety and Health (OSH) through developing and providing curriculum and training programs for workers and employees, employers and those responsible for implementing OSH at the work place.

Assist industries, commerce and others to solve problems relating to OSH.

Assist those who are responsible for OSH with the latest information in the field of OSH, both locally and overseas.

Conduct short term and long term research in OSH related areas that will benefit and bring advantages to the country.

Disseminate information on research findings and to become the centre of reference in the field of OSH.

Organize and participate in various exhibitions, seminar and conferences held nationwide as well as advises and supports industries in their safety and health campaign activities.

As information is essential in realizing the goal of a safe and healthy workplace environment, NIOSH actively undertakes information dissemination activities to reach out to the public with the hope to inculcate safe and healthy work culture.

Information dissemination is one of the important aims of NIOSH which has become in demand by the industries. Indirectly it indicates the increasing level of awareness in OSH among employers, employees and higher learning institutions in India. The infrastructure development and the information technology software's are among the main elements of disseminating information to the industries as well as the public as whole.

### 4.4 CONSTRUCTION INDUSTRY DEVELOPMENT BOARD (CIDB)

Construction Industry Development Board (CIDB) was established by Act 520 of Lembaga Pembangunan Industri Pembinaan Indian Act 1994 in July 1994 as a statutory body under the jurisdiction of the Ministry of Works India. Its main goal is to develop, enhance and increase the competitiveness of the Indian construction industry. Its objectives are to develop the construction industry to be one of the major contributing sectors to the national economy, capable of producing and delivering high quality construction works, value for money and responsive to the nation's need

Meanwhile, among its functions that are related to construction safety is to accredit and certify skilled construction workers and construction supervisors. With this particular function, the board is empowered to conduct 'Safety and Health Induction Course for Construction Workers (SICW)'. Upon successful completion of the said course, the Board shall accredit and certify skilled construction workers and construction site supervisors by issuing the so-called 'CIDB Green Cards' which then allow and qualify them to enter and work at construction sites. The green card holders are also entitled with Takaful Insurance coverage according to the coverage terms and conditions. This card shall complements with all 'NIOSH Safety Passport' issued by the National Institute of Occupational Safety and Health (NIOSH) nationwide. In addition to above, among the activities of the Board is to recognise` outstanding players of the construction industry by staging the so-called 'Indian Construction Industry Excellence Awards (MCIEA)' annually.

Among the new categories introduced by the Board in the year 2006 which include safety and health are:

Small Contractor Award

Construction Professional Of The Year Award

Safety & Health Award

Environmental Best Practices Award

IBS Award

## Local Authority

In addition to that, Local Authorities like Majlis Perbandaran Sandakan (MPS) and others also have important roles and responsibilities in ensuring that all construction projects which fall under their respective areas of supervision comply with the provisions of law and acts related to safety aspects at construction site. They certainly have to enforce and take stern action deem necessary to whoever go against or refuse to comply with the safety provisions of law and acts.

## Client / Project Owner

The client/ project owner's involvement can favourably influence project safety performance by setting safety objectives, selecting safe contractors and participating in safety management during construction. Client or project owner shall ensure that all appointed contractors must provide and submit for approval a complete safety plan and implementation statement that is in accordance with OSH and other safety acts before they commence their construction works at site. This is to ensure that all construction works at site are carried out safely and smoothly so that the project can be completed and delivered as scheduled. If any accident happens at site, this will surely waste time and consequently cause delay in the overall completion of the project. Samelson and Levitt (1982) in their research, have identified that the method used by the owner in selecting a safe contractor where the owner was directly involved in the selection process and also in monitoring and supervision of the contractor's safety programs, contributed significant impact in reducing the accident rate at construction site. In addition to that, the practice of short-term permits in handling dangerous operations, safety emphasis during initial site inspection, safety requirements as detailed in the contract specifications and site inspection, keeping of safety records, emphasis on safety objective upon contractor and also emphasis on safety aspects and good safety records as requirement and criteria in contractor selection process also acted as contributing factors. Providing safety induction and orientation courses and trainings for workers and establishment of management safety committee in monitoring, control, auditing and ensuring the implementation of all safety aspects at workplace are definitely added advantages.

## 5. METHODOLOGY

### 5.1 RESEARCH METHODOLOGY

Field Survey is done to study the predominant environment that involves safety management in the execution of various phases of a construction project. This survey is done to have the first hand information, essential to be aware of the safety problems encountered in the construction projects. The objective of doing a field survey in this study is to validate the findings of the literature review.

### 5.2 PROJECT ACTIVITIES

The method that had been used for this research is by literature review and followed up by data collection using questionnaires. The research starts first with literature review on the topic of safety management in construction project. The pilot survey had been conducted to identify and making sure the effectiveness of the questionnaire survey. The questionnaire survey commenced right after the questionnaire had been improvised according to the pilot survey. Site visit needed to gain actual data from the site. The data from the survey and site visit will then be analyzed to attain the useful information.

### 5.3 DATA COLLECTION

The aim of the data collection is to gather information regarding the safety management in construction project. The data collection will be conducted using Qualitative research and observation which is concerned with testing the theory presented with the objective. The data collections are basically done by:

#### 5.3.1 QUESTIONNAIRE

People are more truthful while responding to the questionnaires regarding controversial issues in particular due to the fact that their responses are anonymous. The questionnaire survey will be distributed to the construction project teams and it will be conducted online.

#### 5.3.2 SITE OBSERVATION

This will be the main alternative to gather information. Through site observation, actual data can be obtained and direct observation gives the most accurate data needed.

## 5.4 ANALYTICAL METHOD

The data analysis will be done after the data collection is finished. All the data collected from the questionnaires will be analyzed and then summarized to obtain the appropriate and suitable result of the safety management in construction project. Data analysis is actually an approach to de-synthesize the data collected. It is a method of putting together facts and figures to solve problems and a systematic process of utilizing data to come up with the answer to the question. The analysis of the survey is done by the Relative Importance Index (RII), Average Index Formula and Cronbach's Alpha (using SPSS Software) method. The scores were then transformed to importance indices based on the following formula.

## 6. RESULT AND DISCUSSION

### 6.1 PILOT SURVEY

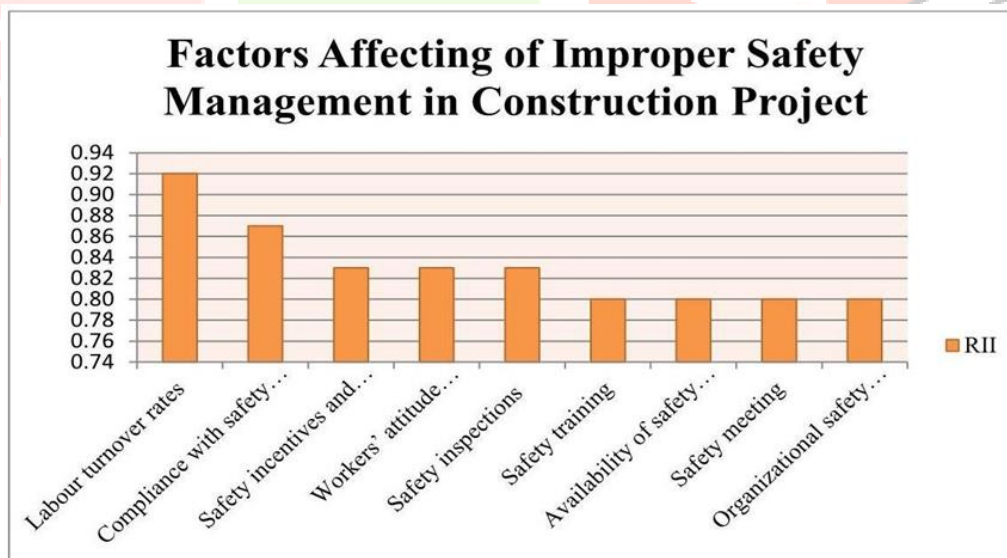
The pilot survey has been done throughout all of the professional engineers either in the academic, construction or consultancy industry. After obtaining and analyzing the results of the pilot survey, logistical, technical and other issues or problems have been addressed. The questionnaire format was revised, or the type of survey had been altered into a more suitable one. After the revision of the survey being made, the large-scale of the survey is executed.

### 6.2 QUESTIONNAIRE SURVEY

The questionnaires had been distributed to the project teams of 40 Units 3-Storey Shop-office development consists of the client, consultant, contractor and companies and had received the feedbacks. Since this study is a qualitative study, 30 feedbacks are sufficient enough. The questionnaire consists of three sections, General Information, Importance of Safety Management in Construction Project and Current Practices of Safety Management in Construction Project.

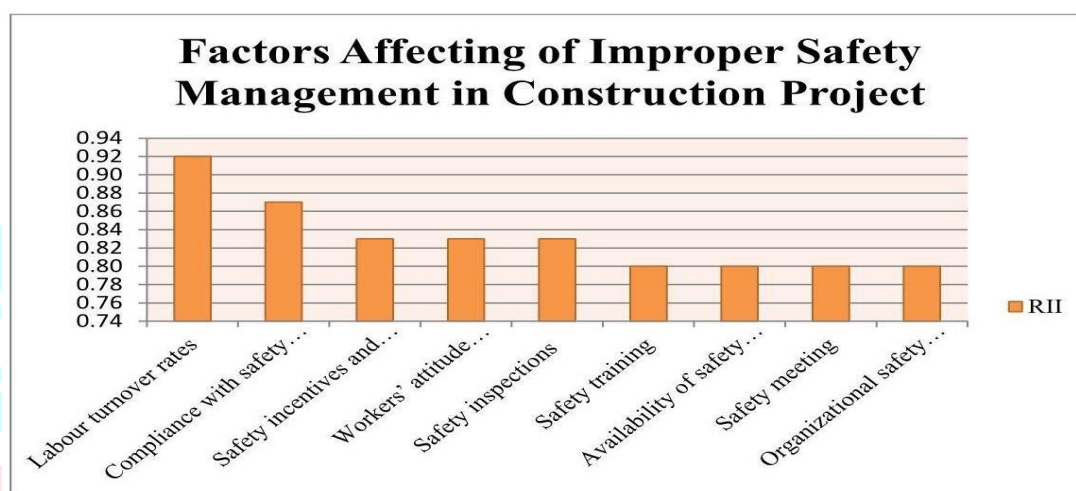
### 6.3 RESULT OF RELATIVE IMPORTANCE INDEX, AVERAGE INDEX FORMULA AND CRONBACH'S ALPHA USING SPSS SOFTWARE.

#### 6.3.1 FACTORS AFFECTING IMPROPER SAFETY MANAGEMENT IMPLEMENTATION IN CONSTRUCTION PROJECT.



**Fig 1 Ranking on the Factors Affecting Improper safety management implementation in Construction Project.**

Rank	Factors	Relative Importance Index (RII)
1	Labour turnover rates	0.92
2	Compliance with safety legislation	0.87
3	Safety incentives and penalties	0.83
4	Workers' attitude towards safety	0.83
5	Safety inspections	0.83
6	Safety training	0.80
7	Availability of safety equipment	0.80
8	Safety meeting	0.80
9	Organizational safety policy	0.80



**Fig 2 Factors affecting Improper Safety Management Implementation**

The respondents rank the first factor affecting of improper safety management in construction is labor turnover rates, with a relative importance index of 0.92. It indicates that labor turnover rates play a very important role in safety management in construction. "Compliance with safety legislation" is graded the second, with a relative importance index of 0.87. The results are a clear indication of poor enforcement of the legislation and poor obedience by construction team project. The respondent grade safety incentives and penalties, workers' attitude towards safety and safety inspections is ranked the third, fourth and fifth respectively, with a relative importance index of 0.83. As for the rest of the factors it is ranked the sixth, seventh, eighth and ninth, with a relative importance index of 0.80.

### 6.3.2 CRONBACH'S ALPHA USING SPSS SOFTWARE

Generally, a questionnaire with an  $\alpha$  of 0.8 is considered reliable (Field, 2009). Hence, this questionnaire certainly is reliable, since the  $\alpha$  is 0.911 (see Table 4.5). The resulted  $\alpha$  should yet be interpreted with caution. Since the amount of items in a questionnaire is taken into account in the equation, a huge amount of variables can upgrade the  $\alpha$  (Cortina, 1993; Field, 2009). For example, if we the reliability analysis of just the items making up the first factor in our research, we get the same  $\alpha$ , but the average correlation is 0.49 instead of 0.43. How huge the alpha should be for a dataset with a particular amount of items is still a point of discussion (Cortina, 1993). Cortina (1993) recommends determining the adequacy of a measure of the level of precision needed. However, since the  $\alpha$  of this questionnaire is far higher than 0.8, we can assume that it is reliable.

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
0.911	0.895	27

Fig 3 Reliability Statistic.

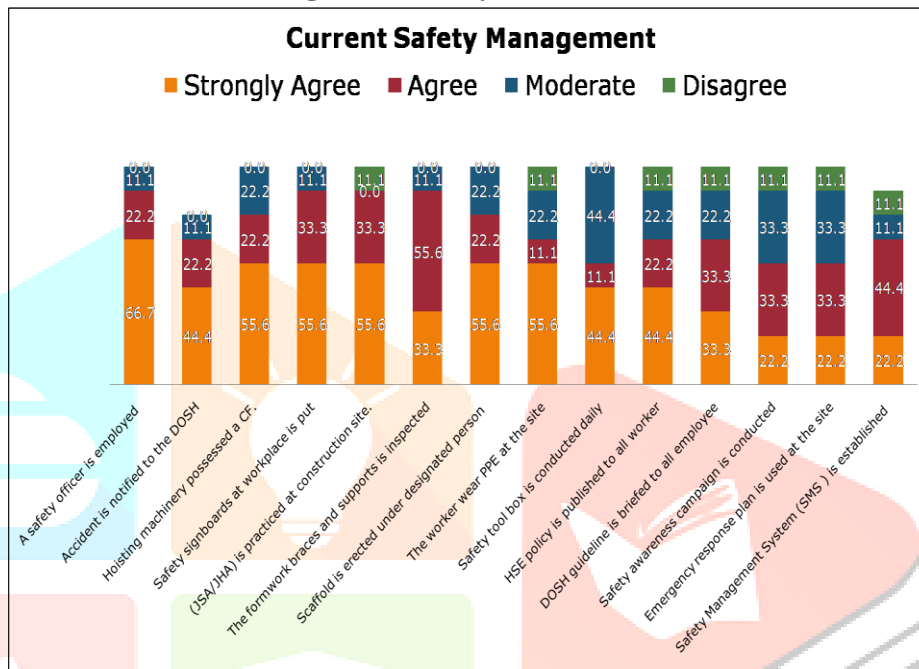


Fig 4 : Current practice of safety management based on the respondent

Based on the questionnaire, site visit performed and informal conversations with the engineer, the author have gathered several data. By comparing those findings, several conclusions can be made in order to comment about the currents practice of construction safety management at the project site. Firstly is the role of safety and health officer. Based on the survey, existence of safety officer is ranked as no 1. This shows that, the company employed safety and health officer for this project. On the other hand, based on the conversation with site engineer, the safety officer at the site has no competency in the safety. This is because in order to become a competent safety and health officer, the e person should attain Green Book Training. This was not implemented by the company. One of the factors is due to cost and salary of paying the safety supervisor. Secondly, there are contradiction of the findings in questionnaires and site visits. Based on the site visits, most of the labour didn't wear Proper Protective Equipment (PPE) at the construction site. For example, one of the workers didn't wear full body harness when concreting at the height above 6 feet. Based on site engineer of the company, the safety enforcement at the site is not stringent. The workers are allowed not to wear PPE at the construction site. One of the reasons why the workers are allowed is because if the management takes any action on the workers, the progress of the site will be decrease as most of the workers do not wear PPE. Several items are not agreed by 11.1 percent of the respondent. The items are (JSA/JHA) is practiced at construction site, the worker wear PPE at the site, HSE policy is published to all workers, DOSH guideline is briefed to all employees, safety awareness is conducted, emergency response plan is used at the site and Safety Management System is established by the company. The factor why they disagree is because probably the company did not really brief their policy of safety to their workers. Other than that, the workers themselves does not really concern and aware about the safety policy of the company. Due to this matter, the safety committee must take proper action in ensuring all of the workers know about the safety policy, current practice of the company and program conducted.



## 6.4 SITE OBSERVATION FINDINGS



## 7. CONCLUSION

Akas Permai SDN BHD is one of the examples of Construction Company in Malaysia that had poor construction safety management. However this does not show the overall situation in other construction site in the whole country. The company is main contractor for this project, but yet they failed to follow all the rules and regulation of the authority like enforcing the worker to wear PPE at construction site and not to use prohibited machinery like Monkey Hoist. One of the factors that the author can conclude is that the company does not encounter any big safety issues like accident involving death and assets. Thus, they feel comfortable with the condition right now. In addition, the local authority does not emphasize on safety precaution. For example, the usage of the Monkey Hoist is not a serious matter in this state although it has been prohibited by DOSH. Another possible factors lead to this low safety awareness is due to high cost of paying for PPE, Safety and Health Officer Training and salary. It is a big investment to small capital Company like Akas Permai SDN BHD Construction. In terms of methodology, the questionnaire does not provide actual result as compared to direct observation. Beside the respondents wanted to finish answering the questionnaire quickly, they are not showing real responsibility towards their answer. This can be seen in the result of questionnaire whereby the result is not as similar in the site like wearing PPE at the construction site. Thus direct observation seems to have more reliable source. Besides that, small numbers of respondents have given inaccurate results based on how their answering the questioner caused by time constrain or pressure at work site.

As the recommendation, the management of the company has to realize the performance of the company in safety management as they play a big role in this matter. One of the ways is by restructuring the safety management team. This is to ensure that safety matters are taken cared by a responsible person. Besides that, the government should give the privilege to small construction company in order to set up a systematic construction safety management system. In addition, government should provide free Green Book Training to the workers. Thus, this will enhance the capability of the company to control safety matters in the construction site. Based on the research done, it can be concluded that safety management in construction project needs to be further improved and monitored frequently for its effectiveness. From the survey conducted on the case study, it is believed that the members of the project team had the awareness about safety management in construction project. However, improvements in many aspects need to be considered in order to ensure the effectiveness.

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