

CURRENT SAFETY MANAGEMENT IN THE THAI CONSTRUCTION INDUSTRY

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ABSTRACT: The aims of this research are to study the current safety management in the Thai construction industry and propose countermeasures to improve the safety performance. The data were collected through one-to-one interviews with 98 injured workers and site investigations from 23 construction projects in Bangkok and the surrounding provinces. The current safety management and practices were examined, and factors that influence occupational injuries were discussed. The study found that substandard facilities and conditions coupled with workers attitudes and beliefs were major factors of accidents. Using adequate personal protective equipment of construction workers could reduce injury accidents by as much as one-third.

Keywords: *Accidents, Causes of accidents, Construction accident, Safety, Safety management, Thai construction industry*

1. INTRODUCTION

The construction industry plays a vital role in developing the infrastructure in both developed and developing countries. However, labor accidents burden the construction industry with direct and indirect financial and economic losses¹⁾ and not to mention bad publicity. The accident rate in the construction is higher than other industries and accident on the construction sites are more serious than accident in the factories^{2, 3, 4, 5)}. In order to prevent accidents^{6, 7)}, it is essential to study the current situation of safety practices and to identify root causes of the accidents.

The safety issue is much concerned in the developed countries. Laws and regulations related construction safety are enacted and strictly enforced to most levels of construction sites. Moreover, the education level and awareness of human right of the construction workers make the employers and employees follow the laws and regulations and take their responsibilities⁸⁾. Even though the developed countries have many studies on

construction safety, the number of fatal accidents do not significantly decrease.

In contrast, safety is less concerned among the involved parties in the developing countries, like Thailand. It is difficult for Government officers to widely investigate and control the construction sites because of shortage of staffs and budget⁹⁾.

Safety conditions in the workplace in Thailand, including construction sites, have not improved much in the 1990's. Government officers and contractors seem to have given less priority to proper safety management while contractors have tried to avoid following the safety laws and regulations⁹⁾.

Safety reports in Thailand do not always contain all the necessary data on the root causes of accidents. Furthermore, employers do not report all serious accidents to the authorities because they may lose benefits¹⁰⁾.

Moreover, the bidding process of construction project in Thailand highly emphasizes the price competitiveness and gives low priority to performance of contractor. It makes contractor minimize the safety budget first for increasing the competitiveness. The consultants focus on the technical aspect and they do not take any responsibility for safety programs. Therefore, many parties involved in the Thai construction industry do not keep the safety aspect in the important priority.

The objectives of this research are to study the current safety management and practices in the Thai construction industry and propose countermeasures to improve the safety performance in the construction sites. The major immediate causes of labor accidents and factors that influence occupational injuries are also examined. One-to-one interviews were conducted with the injured workers who have suffered from accidents within one month prior to the interview and were also absent from work more than one day. Site conditions were investigated for evaluating the situation of construction project and management performance. The study has focused on the construction projects in Bangkok and the surrounding provinces because these areas account for the largest percentage of accidents in the country.

2. THE CURRENT SAFETY PRACTICES

Statistics from the National Statistical Office of Thailand, the International Labor Organization (ILO) and Ministry of Labor and Social Welfare show that the accident rate in the construction industry is higher than the average of the whole industries since the beginning of 1990s. Especially in 1997 and 1998, the compensation to construction injured workers in the Thai construction industry is 220 and 158 million Baht, respectively. Suppose that the direct and indirect losses ratio in Thailand is similar to the ratio studied by Heinrich¹¹⁾, the total cost of construction labor accident may go up to 1,100 and 790 million Baht in 1997 and 1998, respectively.

The safety programs are deployed at several foreign construction companies, especially at the Japanese construction companies, but they are few implemented in the Thai construction companies. Only few Thai leading construction companies started implementing the safety programs in the large-scale project.

Safety laws and regulations enforced since 1972 are The Health and Safety Work Act 1972. Only six of the 17 issues of safety laws and regulations are

directly related to health and safety in the construction. The six issues of safety laws and regulations are safety on construction sites, piling work, cranes, scaffolding, temporary material lifts and from falling objects, falls, and collapse of structures. The significant substances of the laws and regulations are that the contractors shall provide adequate personal protective equipment, free hazard working areas and equipment to their workers and enforce their workers to follow the standard manual and the safety regulations and laws.

3. CHARACTERISTICS OF THAI LABOR ACCIDENTS

Previous studies in the developed countries indicate the pattern of accidents in construction industry has changed little over the years: the most frequently occurring type of accident is falling^{12, 13)}, especially from the high levels¹⁴⁾. The accidents mostly involved the middle age groups and non-experienced workers. Accidents are more likely to occur to young and elderly workers, whose accident rate is 2 or 3 times higher than the average rate¹⁵⁾. Most of the victims were males and the accident risk was the highest for workers in their first year in the construction industry. The risk, however, decreases with experience especially for those who have been working for more than 5 years. The risk of accidents for subcontractor's workers was higher than that for main contractor's workers. The subcontracting has increased the accident risk 1.66 times compared to the main contracting¹³⁾.

In the developing countries, there have not been enough studies on the construction safety. It is observed that the workers are generally unskilled or semiskilled, poorly paid, temporarily employed, have low production (productivity) rates, and often migrating in groups from one place to another, in the search of work¹⁴⁾. They are not trained in the safety practices and there seems to be lack of management commitment in the safety programs and various safety procedures.

The following results are found in this study. A higher number of accidents have occurred among the male workers compared to the female workers: 88 percent of the injured workers were males. Additionally, the rate of male workers on seven sites was studied. About 70 percent of one thousand workers found on these seven sites was males. Therefore, the accident rate for the male workers was higher than that for the female workers. Old workers have higher probability to meet accidents than young workers. In addition, occurrence of

accidents concentrates in the morning and the start and finish hours in the afternoon. The accident occurrence rate on Sundays was the highest compared to other days of the week. Moreover, many accidents occurred after the pay-day. Many workers have heavy drinks after the pay-day. It is speculated that this heavy drinking habit among workers may lead to an accident. The three most frequently occurring types of construction accidents in Thailand were being struck by falling objects, stepping on or striking against objects and falling from the height, which were 23, 23 and 21 percent of all accidents, respectively. Fifty-four percent of accidents have occurred to carpenter. Injured carpenters perceive that their works are the most dangerous activity because they are "on the front edge" and temporary activity.

4. THE CAUSES OF CONSTRUCTION ACCIDENTS

The causes of labor accident in the Thai construction industry are studied to understand that why does accident occur and to propose appropriate safety program for preventing occurrence of causes of accidents. The bad safety conditions and accidents in the Thai construction sites may be attributed to⁹⁾:

1. lack of safety self-awareness of construction workers.
2. lack of work related knowledge.
3. low expenses incurred by accidents.
4. poor enforcement of safety laws and regulations.

Major immediate causes and factors that influence labor injuries have to be studied to identify the root causes of labor accidents in Thailand. Here the major immediate causes of accidents are the causes that directly hit the victims at the time of occurrence while the root causes are all possible causes that lead to an accident. A hypothetical model of factors influencing labor injury was developed from the previous research. The major immediate causes and factors are assumed to be attributed to unsafe equipment, job site conditions, unique nature of industry, unsafe methods, human element, management, and act of God. The model is shown in Figure 1.

The study found that the first three immediate causes of labor accident in the Thai construction industry consist more than 50 percent of the all accidents. Unsafe acts on the construction sites were

the major immediate causes for seventy-seven accident cases and they were related to failure to use personal protective equipment, improper loading or placement of equipment or supplies, failure to warn co-workers or to secure equipment, improper use of equipment, etc. The Pareto diagram as Figure 2 shows the results of the survey.

The factors influence occupational injuries in the Thai construction industry are:

1. Equipment: most construction projects do not have equipment maintenance programs. Repairs are done only when a worker finds the equipment to be out of service or fail to function. Moreover, the covering of moving parts and electricity protections are removed in the most construction machines. The survey shows that 15 of 98 injured workers were working with the unsafe equipment at the time of occurrence of accident. No cover of moving parts and electricity protection directly causes in two accidents in this survey.
2. Job site conditions: due to lack of a good site layout planning and construction pre-planning, the material and equipment are in poor arrangement. In addition, contractors do not normally level and clean the workplace after each task is finished. The site is cleaned after the completion of major part of structural and architectural works. Forty-nine percent of injured workers were working at the poor housekeeping working areas. Thirty percent were working at the excessive noise working areas, and 12 percent were working at the poor illumination working areas at the time of occurrence of accident.
3. Unique nature of construction work: the nature of construction work is highly temporary and most of temporary works are carried out at the high places. The rate of accidents occurrence at high places seems to be higher than that at the ground levels. Thirty-eight of 98 injured workers suffer from an accident at high levels while 23.8 percent of four hundred workers found on construction site work at high levels. One of the unique natures of the Thai construction work is using many transient work forces. The average time when a seasonal worker from the agriculture sector has the first accident is the sixth month while a construction worker has the first accident in the 10.5th month. It can be summarized that the seasonal workers have a higher chance to suffer from construction accident than construction workers.

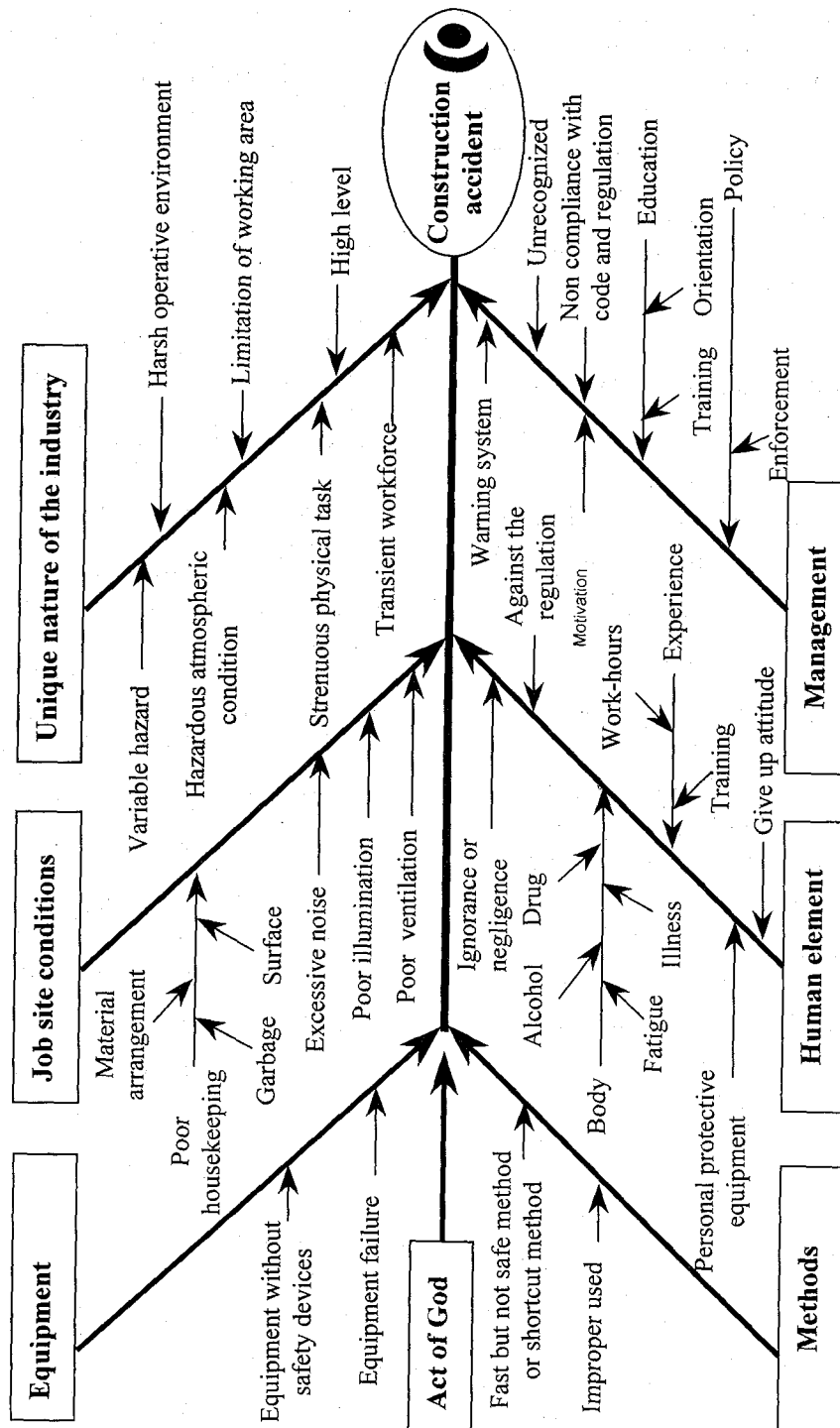


Figure 1: Factors affecting the occurrence of accident

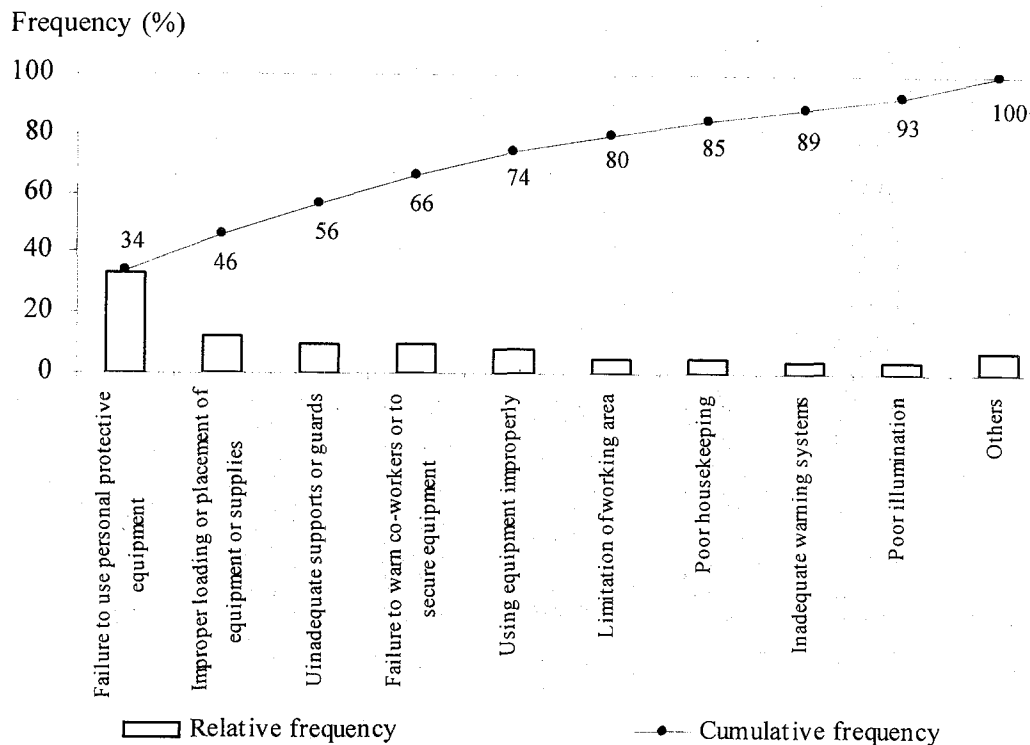


Figure: 2 Major immediate causes of labor accidents in the 98 accidents

4. Method: the standard working procedure was not established on most construction sites. Less training to workers and less recognition from engineer lead workers to use fast but not safe method or shortcut method. The survey shows that 18 injured workers suffer from an accident when they were working with wrong procedure or shortcut method. For example, concrete workers always stay on the concrete bucket when the crane was carrying the bucket from the concrete truck at the ground level to pour at high levels.
5. Human element: sixty-nine workers have inadequate personal protective equipment. Occurrence of one-third of these accidents could have been prevented if workers had used adequate basic personal protective equipment. Seventy percent of 98 injured workers in the survey have a strong "give up" attitude with the accident. They think that occupational accidents are due to their bad luck and that the accidents are unavoidable and acceptable. Normally, workers are unwilling to use personal protective equipment because they are not familiar to use it. The reasons for workers unwillingness to use hard hat are shown in Figure 3. Forty-four injured workers have the opinion that their productivity will be reduced if they wear the hard hat. Regarding workers' experience, this study demonstrates that the probability that

workers suffer from an accident will be decreased when workers have more construction experiences.

6. Management factors: most management in construction project do not have safety policies and do not take any steps to improve safety on construction sites. Moreover, management do not provide the necessary warning systems and protective equipment to their workers. The management do not employ any safety program to train their workers. They think that safety programs are costly and lower workers' productivity. The results of compliance with building codes and safety laws and regulations from the site investigation and interviews with injured workers in 23 construction projects in Bangkok and the surrounding provinces are shown in Table 1. Most contractors do not comply with the safety laws and regulations that are related to the temporary activities. For example, many contractors do not comply with the scaffolding work regulation because the scaffolding is used for temporarily or short time. They can minimize the cost of installation and removal by reducing rail guard or fence around the form-work. Moreover, in the construction site located in the rural areas, the contractors do not comply with the safety laws and regulations because of weak enforcement from the Government officers.

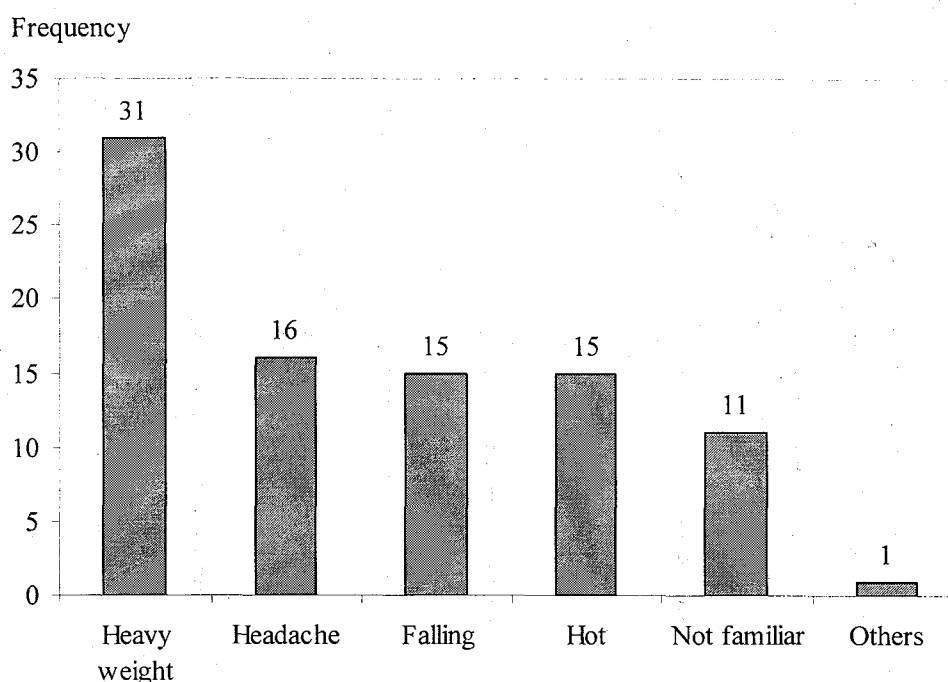


Figure 3: The reasons for workers' unwillingness to use hard hat

Table 1: Compliance with building codes and safety regulations and laws

Safety regulations and laws	Compliance	Partial compliance	Non compliance
1. Construction site	15	4	4
2. Pilling work	N/A	N/A	N/A
3. Scaffolding work	7	11	4
4. Crane operation	8	12	1
5. Temporary material lift	5	6	0
6. High potential hazard from falling objects, falls , and collapse of structure	8	9	4
Compliance: Contractor comply with the safety regulations and laws			
Partial compliance: Contractor comply with safety laws and regulations in some items			
Non compliance: Contractor do not comply with safety laws and regulations			

5. COMPENSATION TO INJURED WORKERS

The compensation fund for injured workers was founded in 1994 under the resolution of the council of Ministers. The aim of this fund is to pay compensation to laborers in case of occupational injury. Employers respond to pay the compensation premium, which will be paid based on the safety performance of construction companies. Officially, all construction workers are covered by this fund that is stipulated in the construction laws. The standard safety procedure or the common procedure

for safety management in the construction site is shown in Figure 4.

The compensation to fatal workers in the Thai construction industry is not high. This survey found that the actual compensation to the fatal workers in the last three years (1996 - 1998) ranges from 8,000 – 200,000 Baht per fatal case (21,200 – 530,000 ¥). The average actual compensation is 76,233 Baht per fatal case (202,036 ¥). However, based on the safety laws and regulations, the compensation will be paid 208,000 Baht (537,756 ¥) to fatal workers if the worker is covered by this fund. The survey of 98 injured workers from Bangkok and the surrounding

provinces shows that only 70 injured workers are covered by this fund. Therefore, the contractors or injured workers have to bear the cost of injury and compensation when a worker who is not covered by the compensation fund suffers from an occupational accident. The amount of compensation paid to the injured workers varies depending on type and size of construction company, working duration of fatal workers, cause of the accident, etc.

Actually, the injured workers who are not covered by the compensation fund can get only the medical fee from their employer. However, only workers covered by the compensation fund follow this standard procedure. The key person to run the safety prevention program and the standard safety procedure in the Thai construction is the safety officer. The construction site, where the number of construction workers is more than 50, has to employ the safety officer, who has the professional safety officer certificate, for planning, supervising and controlling on site safety matters.

6. COST OF PERSONAL PROTECTIVE EQUIPMENT

The analysis of this study found that using adequate basic personal protective equipment (PPE) of construction workers could prevent one-third of injury accidents in the Thai construction industry. Many contractors are concerned that the initial cost of the basic PPE is costly, but they do not consider that the basic PPE has rather long life duration. The comparison of cost of the PPE and the general equipment, which are in daily use by most workers, is shown in Table 2.

The annual cost of the basic PPE is 173 Baht while the annual cost of the general equipment ranges from 71-150 Baht and the average is 110.5 Baht. Thus, the difference in between these two annual costs is smaller than it first looks. Furthermore, the injury accident could be prevented by one-third as a result, the compensation to injured workers is estimated to be reduced by 50 million Baht annually in the whole Thai construction industry.

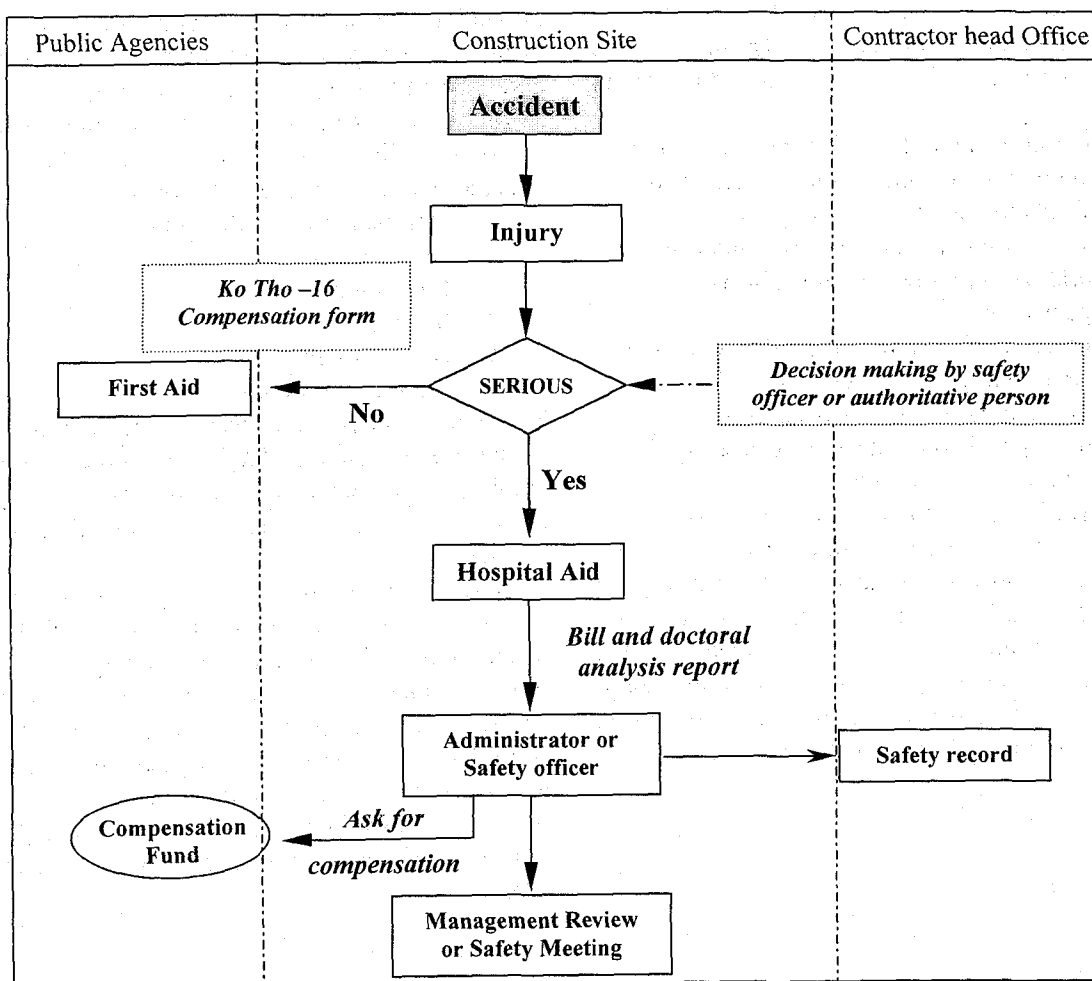


Figure 4: Standard workflow of accident cases in the Thai Construction Company

Table 2: Comparison of cost of personal protective equipment and general equipment

Safety Equipment	Cost (Baht)	Used Duration (Year)	Annual Cost (Baht / year)
Personal Protective Equipment (PPE)			
Hard hat	60	3	20
Safety shoes	400	3	133
Other items	20	1	20
Total cost of PPE			173
General equipment (No PPE)			
Boot	50	0.5	100
Canvas	130	1	130
Slipper	25	0.35	71
Other items	20	1	20
Total cost of General equipment			71-150

7. SAFETY PROGRAMS

A main objective of safety programs is to minimize the injury accident and to improve the safety performance in the construction industry. The safety programs are designed based on the factors affecting the construction accident (Figure 1) and Parato's law (Figure 2). to overcome the current problems.

1. Contractors should provide basic personal protective equipment to their workers and enforce their workers to use it.
2. Safety training programs and regulations should be implemented and followed, respectively.
3. Contractors should provide sufficient clean-up time to improve cleanliness and housekeeping in the construction sites.
4. Daily supervision and toolbox meetings should be implemented.
5. Warning signs should be used to alert workers to dangerous conditions.

In order to prevent occurrence of factors that influence occupational injuries, the activities are proposed to improve the safety aspect in the preplanning, communication and work coordination and safety consciousness matter. The proposed safety activities are shown in Table 3.

8. CONCLUSIONS AND RECOMMENDATIONS

The current safety management and practices in the Thai construction industry and all possible major immediate causes of accidents and factors that influence occupational injuries were investigated and assessed in this survey. The major immediate causes of accident were related to unsafe acts of workers. The most influential factors of occupational injuries are as follows:

1. Unique nature of the industry
2. Job site conditions
3. Equipment
4. Methods
5. Human element
6. Management factors

The major immediate causes of accident are failure to use personal protective equipment, improper loading or placement of equipment or supplies, failure to warn co-workers, and inadequate supports or guards.

Safety programs are proposed to prevent accidents and minimize influential factors in occupational injuries and major causes of accidents. Improvement on these aspects (e.g. by providing adequate personal protective equipment to workers) could have reduced thirty-three percent of accidents in this study. Safety training programs to increase self-safety awareness should be implemented to reduce unsafe acts of workers on the construction sites.

Table 3: Proposed safety activities for preventing occurrence of factors that influence occupational injuries

Activity	Parties in construction				occurrence of factors to be prevented
	Client or client representative	General contractor	Foremen or headmen	Workers	
Preplanning		Construction schedule			<ul style="list-style-type: none"> • Limitation of working area and poor illumination • Using equipment improperly and poor illumination • Improper loading or placement equipment or supplies
		Material and equipment			
		Preparation work procedure			
Communication and work coordination		Daily monitor meeting			<ul style="list-style-type: none"> • Failure to use personal protective equipment, improper loading or placement equipment or supplies, and failure to warn co-workers and secure equipment.
		Weekly meeting			
		Monthly meeting			
Enhancement of safety consciousness			Daily cleaning		<ul style="list-style-type: none"> • Poor housekeeping • Failure to use personal protective equipment, inadequate supports or guards, and inadequate warning systems. • Improper loading or placement equipment or supplies • Using equipment improperly and failure to use personal protective equipment
			Weekly cleaning		
		Daily safety inspection			
		Weekly toolbox meeting			
		Orientation for new comer			

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タイ国の建設労働安全マネジメントの現状

Tirachai PIPITSUPAPHOL and Tsunemi WATANABE

建設現場の事故・災害は、人命の喪失、災害に関する直接・間接費用の増大、建設行為に対する負の印象の増幅など、タイ国の建設業界にとって看過できない問題となっている。

本研究は、タイ国の建設産業における安全マネジメントの現状を調査し、安全の向上に資するための対策を提案することを目的とする。バンコク市並びに その郊外 23箇所の現場で98人の被災者の方々に一対一の聞き取り調査を行い、建設労働安全マネジメントの現状並びに労働災害の発生要因を把握することを試みた。調査の結果、不十分な安全施設、労働者の低い安全意識、基礎的個人防護具の未使用、資機材の不適切な運搬・設置、他者による不十分な注意喚起などが事故発生の主な要因であることが明らかとなった。また、基礎的個人防護具を常時使用することによって、約 1/3の傷害事故の発生を未然に防止できると推測された。