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THE UNIVERSITY OF HONG KONG

EFFECTIVENESS OF SAFETY MANAGEMENT SYSTEM ON HONG KONG CONSTRUCTION INDUSTRY UNDER FACTORIES AND INDUSTRIAL UNDERTAKINGS (SAFETY MANAGEMENT) REGULATION

A DISSERTATION SUBMITTED TO
THE FACULTY OF ARCHITECTURE
IN CANDIDACY FOR THE DEGREE OF
BACHELOR IN SURVEYING

DEPARTMENT OF REAL ESTATE AND CONSTRUCTION

BY

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HONG KONG

APRIL 2006

Declaration

I declare that this dissertation represents my own work, except where due acknowledgement is made, and that it has not been previously included in a thesis, dissertation or report submitted to this University or to any other institution for a degree, diploma or other qualification.

Signed : _____

Name : _____

Date : _____

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Abstract

This dissertation studies the effectiveness of safety management system for building works and civil works respectively after it has become mandatory under the Factories and Industrial Undertakings (Safety Management) Regulation in April 2002. In the past, the government adopted the enforcement approach in order to reduce construction accidents. However, statistics showed that this approach cannot fulfill its designated purpose. In order to solve the problem in the long run, the government decided to shift from the enforcement approach to self-regulation approach hoping to build up the safety culture in Hong Kong's construction industry. It is believed that safety management system could help in building up safety culture and this is the reason for the government to enact the regulation.

Nineteen factors which could potentially be improved by safety management system were included in the questionnaires and respondents were asked to fill in how effective the system is in bringing about these factors. The factors were then ranked by using the importance index. Two rankings, one for building works and one for civil works were generated. Results showed that the three objectives of setting up safety management system, as stated by the Labour Department, occupy at the top positions among nineteen factors under both rankings. Spearman's rank correlation coefficient was calculated for the two rankings and it was found that the two rankings agree with each and other. Three interviews were conducted and interviewees agree that Safety Management System is effective to a large extent. Besides, questionnaires results and interviews both reflected that Safety Management System is most effective in enhancing company's image and competitiveness in bidding for projects.

Chapter 1 Introduction

Background of Research

Hong Kong is well-known for its flourishing construction industry. According to the yearbook 2004, the total labour force was 3.55 million, and among them 267,000 were employed in the construction industry. Viewed from an economic perspective, construction work in 2003 contributed to 4% of Hong Kong's GDP.

Despite its success, the industry has a price to pay for. The accident rate in Hong Kong's construction industry has been remaining at an unacceptable level for years. The number of industrial accidents in construction industry in 2003 and 2004 were 4367 and 3833, they accounted for 25.3% and 21.9 % of the industrial accidents in all industries. The accident rate per 1 000 workers of the industry was 68.1 in 2003 and 60.3 in 2004, overriding that of the manufacturing industry and the catering industry since 1995. The fatality rate is even more alarming. It peaked at 56 fatal cases out of 68 of all industries in 1998. The situation had improved, there were respectively 25 and 17 fatal cases out of 28 and 24 of all industries in 2003 and 2004. On average, about 80% of the industrial fatalities occurred in the construction industry in the last 10 years.

Over the years, many researchers have investigated into the safety performance of the construction industry. Some of them identified factors leading to the occurrence of accidents on construction sites. The government and many concerned parties have taken measures against the potential causes of accidents, aiming at reducing accidents and promoting safety in the industry. The high frequency of construction accident has costed the industry a considerable amount.

The facts tell us that, performance in construction safety has actually shown improvement. Since 1998, the industrial accident rate of the construction industry has dropped steadily. What result in such improvement? Safety measures implemented in recent years did contribute. However, how effective are they really are? In April 2002, the Factories and Industrial Undertakings (Safety Management) Regulation took effect. It was believed this regulation could help building up self-regulation in the industry, which would be more

effective in bringing down accident rate than traditional enforcement approach. There are studies about the effectiveness of safety measures, however, the effectiveness of safety management system after it became mandatory has rarely been studied.

This dissertation tries to look at the construction industry in Hong Kong by giving statistics of construction accidents, identifying common accidents on construction sites, various factors contributing to construction accidents and summarizing regulations and ordinances related to construction safety in the territory. This provides a better insight to the reasons behind different safety measures and policies implemented. The cost of accidents and safety measures will be discussed, so as to give a clear picture of how dear accidents are. The Factories and Industrial Undertakings (Safety Management) Regulation will also be investigated to give a clearer picture on the background and rationale of implementation and its detail. This could serve as a reference for the parties in implementing construction safety measures in the future.

Research Aim and Objectives

The aim of this dissertation is to find out the ranking of benefits that could potentially be brought by safety management system under the Factories and Industrial Undertakings (Safety Management) Regulation and thus evaluate the effectiveness by comparing the ranking with the objectives of setting up safety management system as stated by the Labour Department.

The objectives of the dissertation are:

i. To understand the background information of construction safety, including regulations, policies, measures and so on.
ii. To identify factors causing construction accidents in recent years.
iii. To study the impacts of the Factories and Industrial Undertakings (Safety Management) Regulation on construction safety.
iv. To evaluate the effectiveness of Safety Management Regulation, in building works and civil works respectively, after it has become mandatory under the Factories and Industries Undertakings (Safety Management) Regulations.

Methodology

Basically, three kinds of research methods are used to conduct this study, they include literature review, interviews and questionnaires. Data and information gathered could be more comprehensive as these three methods can act as supplement to each other and give a more complete idea on the effectiveness of the safety management system.

Literature Review

In order to gain a better understanding of factors causing construction accidents, the development of construction safety performance and actions took in order to prevent accidents, relevant information was obtained through extensive reading of books, journals, newspaper cuttings, press releases, government publications and internet browsing for example the homepages of relevant government departments and concerned parties.

As information can be easily accessible through internet, quite a lot of readings were done through browsing the net. Electronic version of regulations or ordinances could be obtained. By studying these legislations, the government's attitudes on construction accidents could be interpreted. Factors leading to construction accidents have long been a focus of different researchers. Therefore, a better insight to the obstacle to satisfactory site safety performance can be gained through reading books and journals. The occurrence of construction accidents, information of any new safety measures and the corresponding and latest actions taken by relevant parties in respond to construction accidents could be acquired through newspaper cuttings, which are also readily accessible on the internet. This provides the most updated information on construction safety.

Actually many researchers have written on costs of accidents. Therefore books and journals could give a clear idea on the composition of construction accident costs. Having a better understanding to costs of construction accident, it will be more directed to get to quantify such costs by other means.

Questionnaire

After reviewing literatures, factors contributing to construction accidents and the components of construction accident costs are identified. This allows us to move on to the second part of data collection. In order to find out the effectiveness of safety management system after the Factories and Industrials Undertakings (Safety Management) Regulation has come into effect, questionnaires were sent to safety officers, safety managers or project managers of the construction contractors in Hong Kong. They were asked to rank the level of potential benefits brought about by safety management system.

Interview

Interview is a very good way of gathering more in-depth information. As interview is a more interactive way of communication, prompt clarifications on the questions or follow-ups on interviewees' answers could be made, thus allowing more complex data to be collected and enhancing their accuracy. Moreover, explanations to the questionnaires findings could be obtained from the interviews with safety professionals in the industry. Safety managers in construction firms were interviewed as they know well about construction safety.

Scope of study

In this study, questionnaires were sent to safety officers, safety managers or project managers of Group B and Group C contractors chosen from the "List of Approved Contractors for Public Works" in the Hong Kong Builder Directory 2005 37th Edition. "B" denotes Group B for contracts value up to $50 million and "C" denotes Group C for contracts of any value exceeding $50 million.

Structure of the Dissertation

This dissertation consists of 7 chapters. Chapter 1 is the introductory chapter. It briefly describes the background, aim and objectives, methodology and scope of the research.

Chapter 2 to 4 are the literature review based on extensive reading of books, journals, newspaper cuttings, press releases and any resources available.

Chapter 2 focuses on background of construction industry in Hong Kong. Statistics of the industrial accidents and fatalities of construction industry are firstly put forward to let reader understand how poor the safety performance is. Secondly, common accidents on Hong Kong's construction sites and factors leading to them are summarized. Regulations and ordinances related to construction safety are also included in this chapter. This provides a better understanding to the causes of the poor site safety performance in Hong Kong and the current legislation in relation to the issue.

Chapter 3 introduces different type of costs arising from construction accidents and also the costs of safety measures. Accident costs are not confined to direct costs like compensation, employers' liability and contractors' all risks policies, a large amount of accident costs usually go to indirect costs, which cannot be insured against. Hopefully, employers would invest more on safety after understanding how costly accidents can be.

Chapter 4 is about the Factories and Industrial Undertakings (Safety Management) Regulation. Here, many researchers' definitions of safety management system are put forward. The objectives of the Labour Department to set up safety management system are also included. Moreover, the details of the regulation can be found in this chapter. This provides a clearer picture on what a safety management system is like and how it actually operates under the law.

Chapter 5 and 6 present the main study of this dissertation. Chapter 5 is Methodology which states how data are collected and processed. Chapter 6 is Data Presentation and Analysis. In this chapter, data collected from the questionnaires and interviews are analyzed so as to find out the rankings of factors which can be potentially improved by safety management system. Safety professionals' opinions towards the rankings and the effectiveness of the safety management system after the enactment of Factories and Industrial Undertakings (Safety Management) Regulation obtained in the interviews are also extracted and discussed here.

Chapter 7 summarizes the findings of the whole study. The limitation of study is identified and suggestions for further study are also proposed.

Chapter 2 Overview of Construction Safety in Hong Kong

Statistics of Construction Safety in Hong Kong

Hong Kong has limited supply of land, thus the density of buildings has to be high enough to accommodate its 7-million-more population. Construction industry contributes a lot to the concrete-forest. It is true that construction industry is important to the society and also the economy. According to the Hong Kong Yearbook 2004, 4% of GDP was contributed by the industry in 2003. Besides, the industry also consumes a large amount of labour force. In 2004, 267,000 out of 3.55 million of the labour force engaged in the construction industry. It was one of the major employment sectors, accounting for about 7% of the total work force. Figure 2.1 shows the number of manual workers engaged on sites from 2001 to 2004.

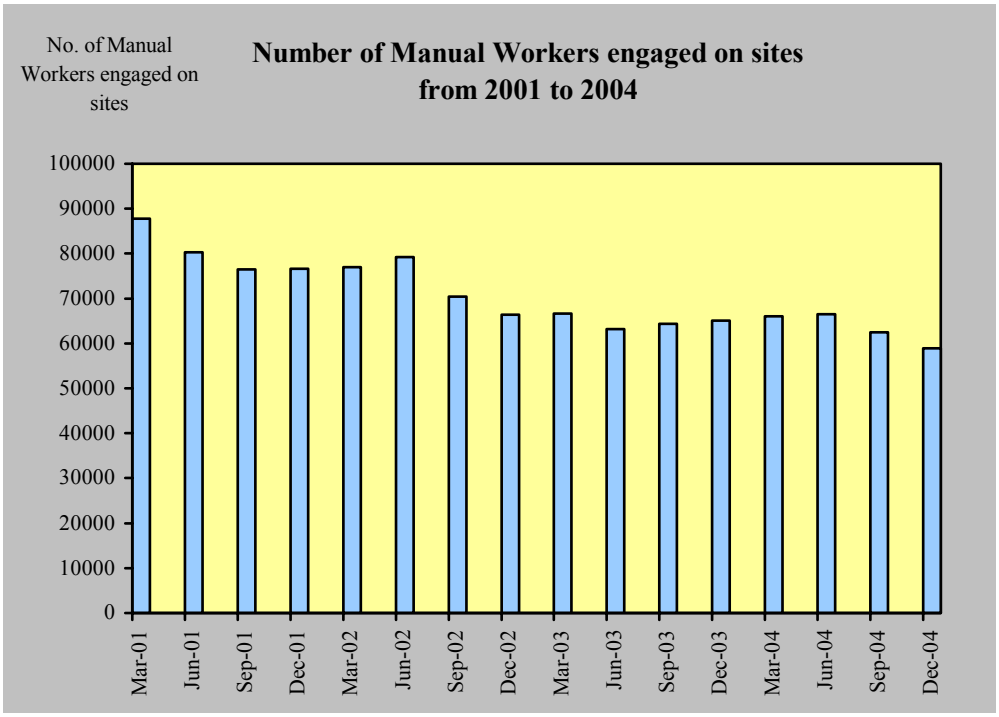

Fig. 2.1 Number of Manual Workers engaged on sites from 2001 to 2004

(Source: Hong Kong Monthly Digest of Statistics)

Construction industry does not only contribute a lot to the economy but it also takes up the majority of industrial accident in the territory. The industrial accident rates and industrial fatality of the construction industry rank first among all other industries, for

instance catering and manufacturing industries. According to the Labour Department, industrial accident is defined as injuries and deaths arising from industrial activities in an industrial undertaking as defined under Factories and Industrial Undertakings Ordinance.

The table below indicates the number and rate of industrial accidents and fatality in all industries, construction industry and selected industries in 2003.

	All Industries	Construction	Catering	Manufacturing
No. of Industrial Accidents	17,533	3,833	-	-
Accident Rate per 1000 Employees	31.5	60.3	51.5	17.5
No. of Fatalities	24	17	-	-
Fatality Rate per 1000 Employees	0.043	0.268	0.000	0.012

Table 2.1 Number and rate of industrial accidents and industrial fatality in 2004

(Source: Labour Department)

The figures below further indicate the trend of industrial accidents and industrial fatality from 1995 to 2003:

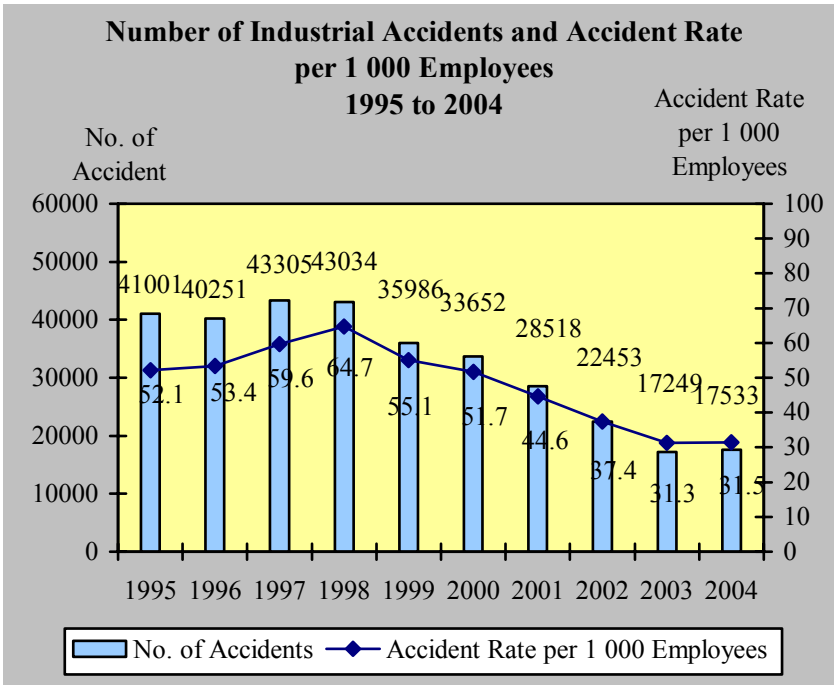

Fig. 2.2 Number of Industrial Accidents and Accident Rate per 1000 Employers from 1995 to 2004

(Source: Labour Department)

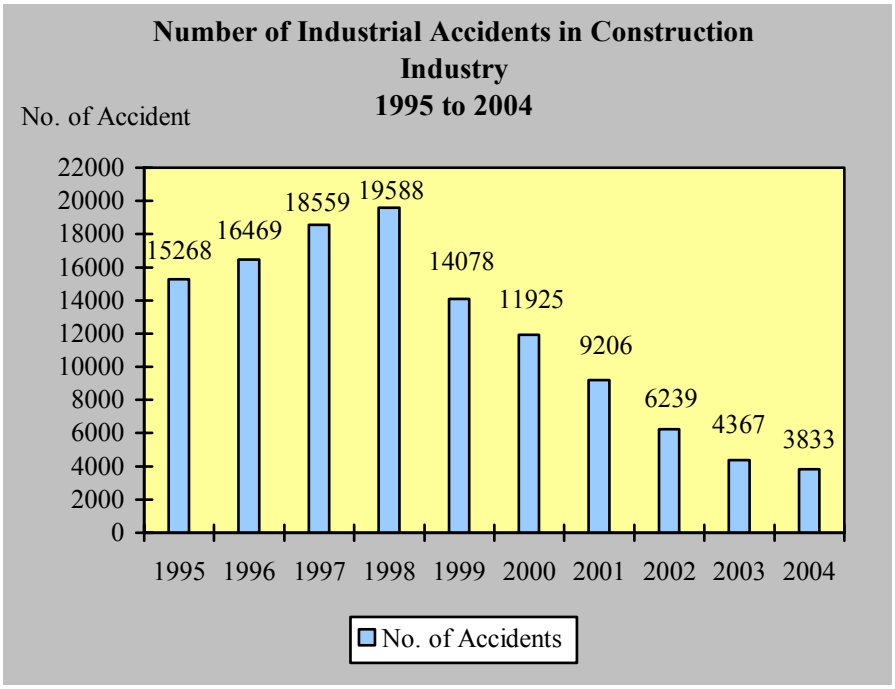

Fig. 2.3 Number of Industrial Accidents in Construction Industry from 1995 to 2004

(Source: Labour Department)

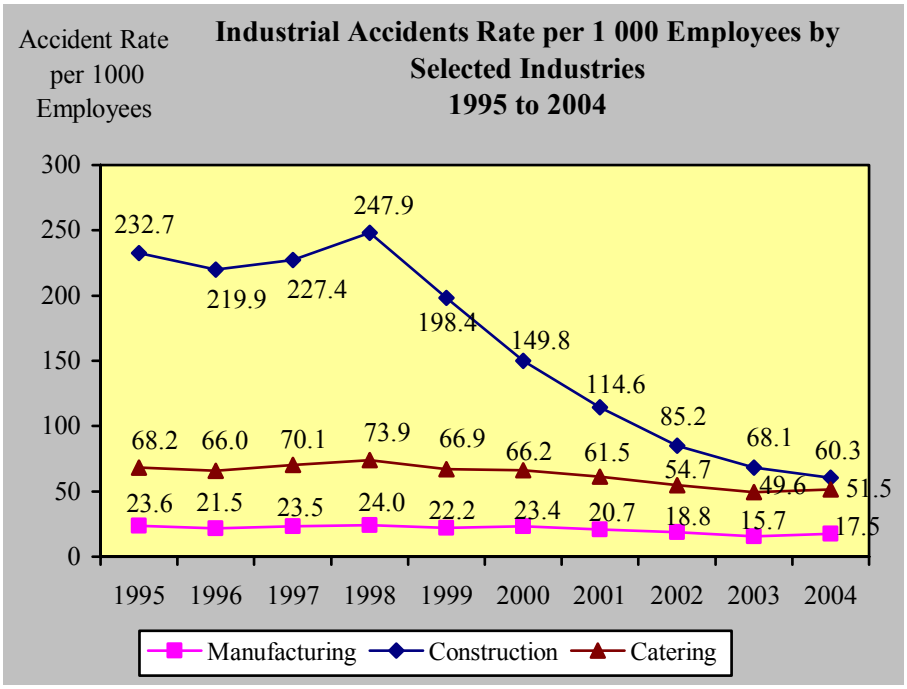

Fig. 2.4 Industrial Accident Rates per 1000 Employees by Selected Industries from 1995 to 2004

(Source: Labour Department)

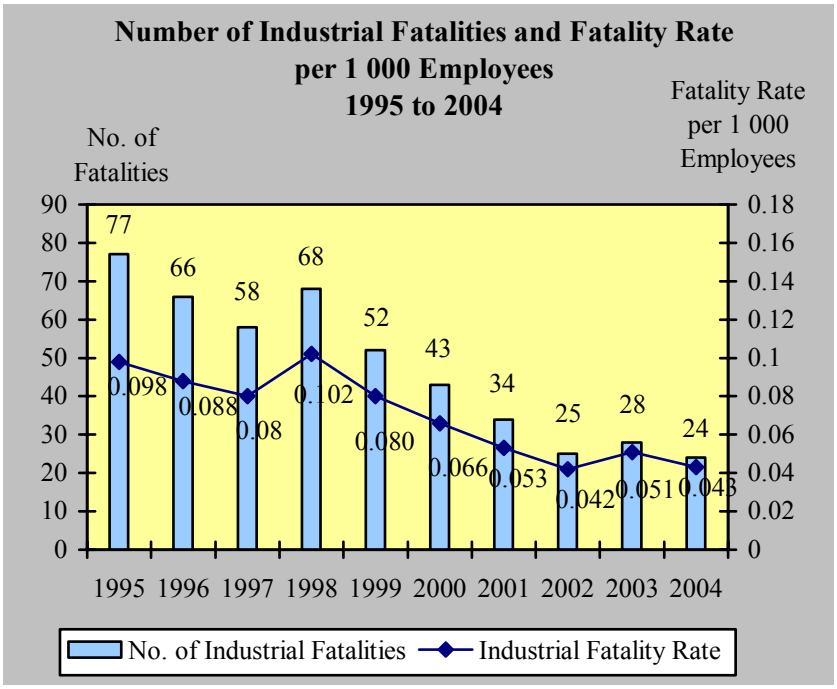

Fig. 2.5 Number of Industrial Fatalities and Fatality Rate per 1000 Employees from 1995 to 2004

(Source: Labour Department)

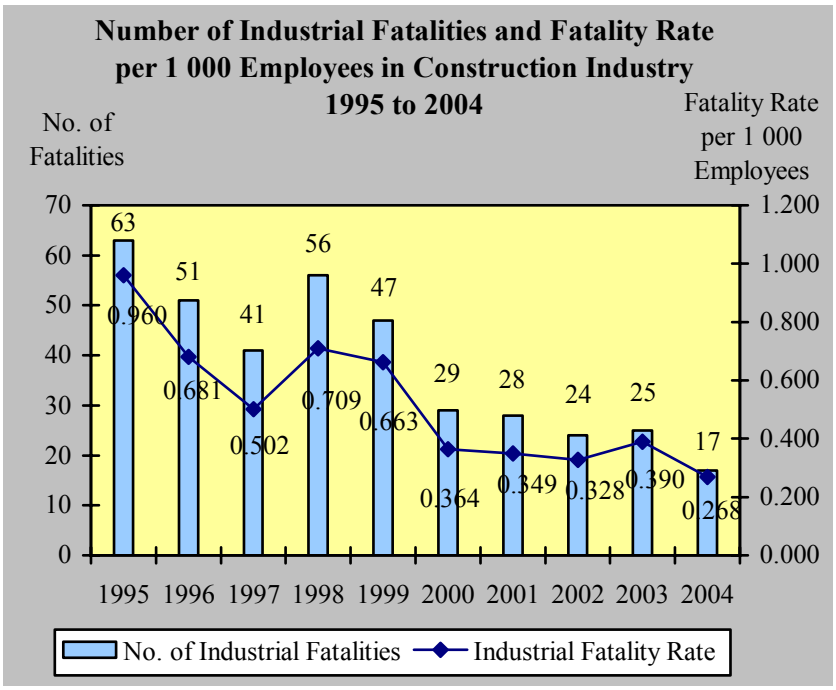

Fig. 2.6 Number of Industrial Fatalities and Fatality Rate per 1000 Employees in Construction Industry from 1995 to 2004

(Source: Labour Department)

Figure 2.3 shows the number of industrial accidents in the construction industry and a decreasing trend of industrial accidents can be observed. From figure 2.4, construction accidents peaked in 1998, having an industrial accident rate per 1000 employees of 247.9. The situation improves dramatically in 5-year time and drops to 68.1 injuries per 1000 employees in 2003. This indicates an improvement in the safety performance. However, from the same figure, the accident rate of the construction industry is still the highest when compared with catering and manufacturing industries. The situation, though improving, persists since 1995. Besides, the industrial fatalities of construction industry are even more alarming. As shown from figure 2.5 and 2.6, construction industry contributes to the majority of industrial fatalities and its industrial fatality rate is much higher than that of all industries.

From the abovementioned statistics, the safety performance still has room for improvement before reaching a satisfying level, otherwise, more lives will be sacrificed. Before looking at how construction accidents are dealt with in Hong Kong's construction industry, the definition of accident, common types of accidents on Hong Kong's construction sites and what actually caused them should first be understood.

Definition of Accident

There have been number of researchers writing on industrial accidents, and more precisely construction accidents. Many of them defined accident. Before discussing factors causing accidents, it is important to first understand what accident is.

Laney (1982) states that the simplest definition of an accident is "an uncontrollable occurrence which results in injury or damage". The events leading up to an accident are controllable in most cases. International Labour Office Geneva (1983) and Kennedy (1997) also agree that accidents don't just happen, they are preventable. All industrial accidents are, either directly or indirectly, attributable to human failings.

Rowlinson (1997) points out that a number of elements which need to be incorporated into the definition if this is to be useful in terms of accident prevention. These elements are:

- lack of management control;
- basic personal and task factors;
- sub-standard acts and conditions – the symptoms of the accident;
- an unplanned and undesired event or incident – the accident;
- an undesired outcome – death, injury or property damage; and
- a cost.

He thus defines accident as:
"... an unplanned incident leading to death, injury or property damage which stems from inadequate management control of work processes manifesting itself in personal or job factors which lead to substandard actions or conditions which are seen as the immediate causes of the accident."

One may wonder what the legal definition of accident is in Hong Kong. Actually, there is no legal definition of accident under the Factories and Industrial Undertakings Ordinance. However, according to S15 (1) of Employees' Compensation Ordinance, a reportable accident is defined as accident which results in either (a) the death of any employee; or (b) the total or partial incapacity of an employee for more than three consecutive days". (Lee 1988)

Common Accidents in Hong Kong Construction Industry

According to Lingard and Rowlinson (1994) accident proneness can be measured by the frequency of accident occurrence. From Figure 2.4, construction industry has the highest accident rate over the years, thus it is said to be more accident-prone than other industries. It is essential to understand why construction industry is more vulnerable to accident than the others. The Labour Department classified construction accidents by types. Table 2.2 shows the number of injuries in 2004 and figures in blankets are the number of fatality:

Type of Accident	**Statistics in 2004**
Striking against or struck by moving object	757 (3)
Slip, trip or fall on same level	662
Injured whilst lifting or carrying	615
Striking against fixed or stationary object	458
Fall of person from height	447 (8)
Contact with moving machinery or object being machines	270
Injured by hand tool	171
Struck by falling object	139 (3)
Trapped in or between objects	136 (1)
Stepping on the object	33
Struck by moving vehicle	32
Contact with hot surface or substance	29
Contact with electricity or electric discharge	16(1)
Exposure to or contact with harmful substance	16
Trapped by collapsing or overturning object	11 (1)
Exposure to fire	10
Exposure to explosion	8
Others	23
Total	**3,833 (17)**

Table 2.2 Table of Construction Accidents in 2004 analyzed by type of accidents

(Source: Labour Department)

The following chart shows the major accidents which contributed more than 5% of the construction accidents in 2004:

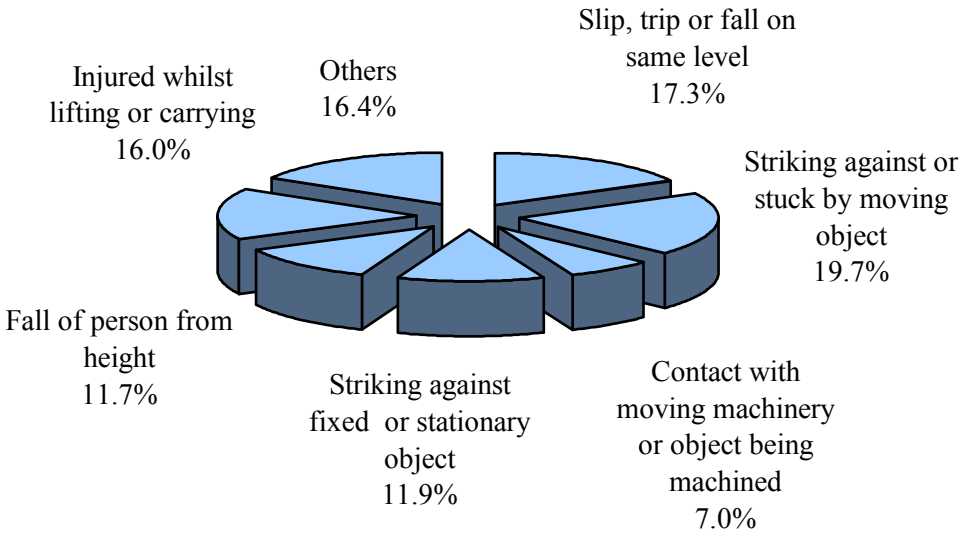

Chart 2.1 6 major accidents on Hong Kong's construction sites in 2004

From the table and chart, we can see that 6 types of accident have more than 5% of the total accidents in 2004 while the rest are grouped as "others" in the pie chart above. The chart indicates that the most frequently-occurred type of accident is "striking against or struck by moving object".

Factors Affecting Safety Performance of Construction Industry in Hong Kong

Many researchers have studied the factors affecting safety performance on construction sites in Hong Kong. Stranks (1994) points out that the reasons of the poor safety record may correlate with many factors such as complexity of the work or system, risk nature of works, management style, safety knowledge and commitment, and personal behaviour.

Company Size

Tam and Fung (1998) study the effectiveness of safety management strategies on safety performance in Hong Kong. In this study, the safety performance of companies is gauged by their accident rates in 1994 as accident rates are steadier throughout the year and they can be easily obtained. In the study, it is found that company size, in term of number of management staff, affects safety performance. Tam and Fung (1998) observe that the accident rate of small companies is highest, the rate for medium sized lies almost at the industrial average and that for the large firms is the lowest. This demonstrates that larger firms generally have better safety records. This could be resulted from the more structured and formalized safety programmes, and stronger management commitment to safety.

Wong and So's (2004) research on safety performance also has similar findings. It is found that the higher number of employees in the organization, the lower figure of the accident rate.

Level of Subcontracting

Wong and So (2004) point out that multi-layer subcontracting is unique to the Hong Kong construction industry and has been the most common practice being used with long history. Subcontractors would normally further subcontract their work without the consent of their principal contractor to several smaller firms in order to minimize their overheads. Poon and Wong (2000) find out that multi-layers of subcontractors is one of the major difficulties in implementing safety management. Recent study carried out by Wong and So (2004) shows the current status of the Hong Kong subcontracting practice and how multi-layer subcontracting system affects Hong Kong construction safety performance. Their questionnaire survey reveals that the majority of respondents (45.5%) would sublet 80-90% of their works to subcontractors. None of the respondents would carry out construction work that fully relies on their own effort, at least 30% of works would be subcontracted out.

Lai (1987) attributes the high site accident rates to the use of labour-only subcontractors. As subcontracted workers are highly mobile, lack loyalty to contractors and are rewarded

according to work done, they are difficult to control. Implementing safety practices on site becomes more difficult. Recent researchers, like Wong (1999) and Lee (1996), believe multi-layer subcontracting system is one of the major causes to poor safety performance in Hong Kong's construction industry. The most extreme case of subcontracting quoted by Lee (1999) was subcontracting up to 15 layers. He describes such multi-layer subcontracting in Hong Kong as common and excessive.

As there is a multi-layer subcontracting system in Hong Kong, it can be imagined that these subcontractors are usually small in size and simple in structure. Wong and So (2004) point out that subcontractors are too small to have time or inclination to keep abreast with legal requirements or technological development in safety. Their study does prove that increase in subcontractors' workers and percentage of work sublet in an organization would lead to poorer safety performance.

Small business, like subcontractors, face with specific health and safety challenges. Many firms lacked adequate resources and were often struggling to survive. Moreover, they lack an understanding of their obligations and the health and safety issues of their processes (Shaw, 1998). These can be supported by Rowlinson's (1999) study for the Hong Kong Housing Authority. He finds that average 84% of workers injured from 1995 to 1998 were subcontractors' workers. Such situation may be due to subcontractors' workers' inadequate training and awareness of safe working practice. Tam and Fung (1998) find there is a significant difference between trained and un-trained employees in relation to accident rate.

Tam and Fung (1998) also study on the relationship between level of subcontracting and safety performance. Their study finds that the high mobility of subcontracted labour makes them less familiar with the site and working environment, which induces high accident rates. It is also not easy for main contractors to enforce their safety programmes as he does not know the people working on site. Limited financial capability of small subcontractors makes them unable to implement comprehensive safety programmes and thus worsens the problem. Besides, subcontractors in Hong Kong are not accountable for serious accidents or for violation of safety regulations. Thus the responsibility of performing safety matters lies on the main contractor.

Communication

According to Wong (2002), communication is a major factor affecting the safety on sites. However, it has seldom been discussed before. Wong (2002) conducts a research to find out the causes of communication problems between main contractors and subcontractors. He identifies 12 factors leading to poor communication in Hong Kong construction industry. Among them, 10 are discussed here as they are more relevant to the territory and have been discussed by other researchers. These factors are listed below:

i. Industry Nature

In order to complete the project on time, construction projects are carried out under almost all sorts of weather conditions. Besides, construction workers are usually not well-educated. These cause communication difficulties.

ii. Industry Culture

Wong (2000) identifies sub-contracting system is a hurdle to construction safety as they are engaged on day-work basis, thus they are not aware to site safety.

iii. Client Type

There are 2 types of clients, public and private ones. Government bodies are public clients. Private clients can be further divided into experienced and inexperienced. Their concern and expectation on site safety performance appear to be different.

iv. Organization Structure

Fryer (1997) suggests that organization structure, including hierarchy, downsizing and decentralization vs. decentralization, rigidity vs. flexibility, rules and procedure, would affect the result of communications. According to Wong (2002), downsizing became popular since 1990s because this can allow flexibility for people for respond more quickly to change.

v. Relationship of Main and Sub-Contractors

The poor relationship between contractors is an obstacle to construction safety. However, such situation could be resolved by partnering. Wong (2002) says that

partnering is considered by most of the project participants as a worthwhile initiative.

vi. Communication Barriers

Hicks and Gullett (1983) points out that communication overload and inattention to message can cause ineffective communication. People may receive more information than they can process or they spend time evaluating the sender and the message before the entire message is being passed or read.

vii. Content of Information

Wong (2002) attributes poor safety performance to the content of information. If content of information, such as method statements, working, drawings or safety procedures, are inaccurate or unclear, safety could not be effectively achieved.

viii. Value of Communicators

Tam et al (2001) point out that many production personnel rank safety in a lower priorities when compare with meeting the production schedule, quota and cost targets. Besides, Nichols and Stevens (1999) mention the failure of many superiors to listen. As a result, safety issue does not receive enough attention.

ix. Provision of Continuous Training

Enrichment of safety knowledge is essential. Teo et al (2005) carry out a study to find out the methods in fostering workers' safe work behaviours. They find that training is an important way to enable workers to work safely, because they are equipped with the knowledge of how to work safely.

x. Workers' Attitude

Workers' incorrect attitude towards site safety is a big difficulty in making safety sites. In Chan et al's (1999) research, it is found that workers do not think they have the duty to comply with safety regulations for the main contractors. They will be more aware to safety issues after serious accident but they will resume their own way of practice shortly after that. Hinze (2002) and Vredenburgh (2002) state that site safety could only be improved if workers change their behaviours towards site safety. Teo et al (2005) also agree that negligence in safety and lack of awareness

to ensure lingering dangers on site would increase the chances of workers getting injured.

Construction Safety Legislation in Hong Kong

Factories and Industrial Undertakings Ordinance, Cap. 59

The Factories and Industrial Undertakings Ordinance is currently the principal legislation in Hong Kong to provide for the safety and health protection to workers in the industrial sector. Rowlinson (2003) regards it as one of the legislation related most directly to the construction industry. It was enacted in 1955 to amend the law relating to Factories and Industrial undertakings and to the employment of women, young persons and children therein. Now, there are 30 items of subsidiary legislation under this ordinance those prescribing safety standards at work. The ordinance is enforced by the occupational safety and health officer of the Labour Department.

According to the government, the focus of the Factories and Industrial Undertakings Ordinance was originally standards setting and enforcement. However, in 1989, an amendment introduced the general duties provisions to incorporate self-regulation. Thus, not only employers are responsible for taking all reasonably practicable steps to ensure the health and safety of all persons employed at the workplace, workers also bear the duties to exercise reasonable care at work and co-operate with the employers on safety measures.

The following listed its subsidiary legislation which covers topics such as safety officers, electricity, working at heights and carcinogenic substances:

i. CAP 59A Factories and Industrial Undertakings Regulations
ii. CAP 59B Factories and Industrial Undertakings (Confined Spaces) Regulations
iii. CAP 59C Factories and Industrial Undertakings (Blasting by Abrasives) Special Regulations
iv. CAP 59D Factories and Industrial Undertakings (First Aid in Notifiable Workplaces Regulations

v. CAP 59E Factories and Industrial Undertakings (Notification of Occupational Diseases) Regulations

vi. CAP 59F Quarries (Safety)Regulations

vii. CAP 59G Factories and Industrial Undertakings (Woodworking Machinery) Regulations

viii. CAP 59H Factories and Industrial Undertakings (Electrolytic Chromium Process) Regulations

ix. CAP 59I Construction Sites (Safety) Regulations

Lee (1996) points out that this set of regulations deals with construction activities on construction sites. Safety and Health Expo (2003) indicates that the regulations laid down the detailed requirements for specific areas of work on construction site.

x. CAP 59J Factories and Industrial Undertakings (Lifting Appliances and Lifting Gear) Regulations

xi. CAP 59K Factories and Industrial Undertakings (Cargo and Container Handling) Regulations

xii. CAP 59L Factories and Industrial Undertakings (Abrasive Wheels) Regulations

xiii. CAP 59M Factories and Industrial Undertakings (Work in Compressed Air) Regulations

xiv. CAP 59N Factories and Industrial Undertakings (Spraying of Flammable Liquids) Regulations

xv. CAP 59O Factories and Industrial Undertakings (Good Lifts) Regulations

xvi. CAP 59P Factories and Industrial Undertakings (Dry Batteries) Regulations

xvii. CAP 59Q Factories and Industrial Undertakings (Guarding and Operation of Machinery) Regulations

xviii. CAP 59R Factories and Industrial Undertakings (Cartridge-Operated Fixing Tools) Regulations

xix. CAP 59S Factories and Industrial Undertakings (Protection of Eyes) Regulations

xx. CAP 59T Factories and Industrial Undertakings (Noise at Work) Regulations

xxi. CAP 59V Factories and Industrial Undertakings (Fire Precautions in Notifiable Workplaces) Regulations

xxii. CAP 59W Factories and Industrial Undertakings (Electricity) Regulations

xxiii. CAP 59X Factories and Industrial Undertakings (Asbestos) Regulations

xxiv. CAP 59Z Factories and Industrial Undertakings (Safety Officers and Safety Supervisors) Regulations

According to Lee (1996), this set of regulations requires the compulsory employment f Safety Officers and Safety Supervisors by proprietors in the construction industry. Under the regulations, when there are 100 or more persons working on site(s), the principal contractor or specialist contractor must employ one registered safety officer on a full-time basis. The duty of a safety officer is to help the proprietor of a construction company to promote the safety and health of persons employed. Safety supervisor must be employed, but not necessarily in full-time basis, when 20 or more workers work on the sites. Their duty is to help the proprietor and safety officer in promoting the safety and health of persons employed.

xxv. CAP 59AA Factories and Industrial Undertakings (Carcinogenic Substances) Regulations

xxvi. CAP 59AB Factories and Industrial Undertakings (Dangerous Substances) Regulations

xxvii. CAP 59AC Factories and Industrial Undertakings (Suspended Working Platforms) Regulations

xxviii. CAP 59AF Factories and Industrial Undertakings (Safety Management) Regulations

Under this regulation, contractors are required to have safety management systems, safety policy and safety committee if there 50 or more workers, as well as construction projects with a contract value of $100 million or more. This regulation is discussed in detail in ***chapter 4****.*

xxix. CAP 59AG Factories and Industrial Undertakings (Loadshifting Machinery) Regulations

xxx. CAP 59AI Factories and Industrial Undertakings (Gas Welding and Flame Cutting) Regulations

Construction Workers Registration Ordinance, Cap. 583

This ordinance is brought into operation on 29th December 2005. This provides the legal framework for the establishment of a mandatory registration system for construction workers to regulate their delivery of work on construction site. All construction workers who carry out construction work on construction sites are required to register in the Construction Workers Registration Authority, which was established to administer the implementation of the Construction Workers Registration Ordinance. Below are the objectives of the Construction Workers Registration Ordinance:

- Ensure the quality of construction works through assessment and certification of the skill levels of all construction workers;
- Ensure the availability of more reliable data on labour supply to facilitate manpower planning and training;
- Raise the status of construction workers statutorily by recognizing their skill levels;
- Provide workers with a clear career path with a view to motivating them for higher skill levels for higher position and remuneration and hence fostering a quality culture in the construction industry;
- Help combating the hiring of illegal workers in construction sites; and
- Assist in resolving wage disputes between contractors and workers with the availability of site entry and exit records.

Other Ordinances and Regulations Related to Construction Safety

Besides Factories and Industrial Undertakings Ordinance (Cap. 59) and Construction Workers Registration Ordinance (Cap. 583), there are some more ordinances and regulations related to construction safety. These ordinances and regulations are listed below:

- *Air Pollution Control Ordinance Cap. 311*
- *Boilers and Pressure Receivers Ordinance Cap. 56*
- *Building Ordinance and Regulations Cap. 123*
- *Dangerous Goods Ordinance and Regulations Cap. 295*

- *Electricity Ordinance and Regulations Cap. 406*
- *Employees' Compensation Ordinance and Regulations Cap. 282*
- *Employment Ordinance Cap. 57*
- *Fatal Accidents Ordinance Cap.22*
- *Fire Services Ordinance and Regulations Cap. 95*
- *Industrial Training (Construction Industry) Ordinance Cap. 317*
- *Legal Aid Ordinance Cap. 91*
- *Pneumoconiosis (Compensation) Ordinance and Regulations Cap. 360*
- *Public Health and Urban Services Ordinance Cap. 132*
- *Noise Control Ordinance and Regulations Cap. 400*
- *Radiation Ordinance and Regulations Cap. 303*
- *Road Traffic (Traffic Control) Regulations Cap. 374*
- *Summary Offences Ordinance and Regulations Cap. 228*
- *Watchmen Ordinance and Regulations Cap. 299*
- *Water Pollution Control Ordinance Cap. 358*
- *Waste Disposal Ordinance Cap. 354*
- *Builder's Lift and Tower Working Platforms (Safety) Ordinance Cap. 470*

Summary

In this chapter, statistics of construction safety, common accident types, factors affecting safety performance and legislations related to construction safety have been reviewed. Statistics shows the unacceptable construction safety performance in the past and it reached the peak in 1998. It revealed that fact that enforcement approach was proved a failure in improving construction safety. Therefore, the government introduced safety management system to the industry, hoping to establish a self-regulating atmosphere. Statistics also reflects significant improvement in construction accidents from 1999 onwards. Besides, government keeps introducing new legislation, for example the Construction Workers Registration Ordinance, and amending existing legislations to cope with the industry. Though the accident rate becomes stagnant in recent years, the fact shows the government's determination in improving the industry to an accident-free one.

Chapter 3 Accident Costs and Safety Costs

Introduction

Lee (1991) mentions that, the construction industry in Hong Kong, especially for building projects, has a very poor safety record. According to Hinze and Raboud (1988), it is a common perception that "safety" is unproductive and not vital to the success of a project as contractors may not be appreciated by just keeping good safety on sites. However, it should be noted that accidents do not just lead to injury and loss of lives, a huge amount of accident costs is induced as well. Accordingly, safety investment in construction projects could better the safety performance and avoid the huge amount of accident costs. Ridiculously, Cheung (1993) finds that most contractors are not willing to invest their money, time and effort to operate and to maintain effective safety programmers. They are not fully aware of the costs of an accident.

Over the years, there have been many studies of the cost of accidents and it is found that, accident costs could be huge. Rowlinson (1997) identifies that cost of an accident is not only constituted of hospitalization and compensation costs of the individual involved in the accident. De Saram and Tang (2005) admit that construction accidents may result in numerous damages and losses. By understanding all the costs incurred by construction accidents, contractors might be surprised, and thus realize the importance of site safety investment.

In this chapter, by reviewing literatures, costs of accident will be identified and reviewed. Besides, the investment on safety will be investigated. Finally, the optimized safety costs will be discussed.

Accident Costs

Many researchers have worked on identifying accident costs. De Saram and Tang (2005) warn construction accidents may result in considerable damages and losses. Among these damages and losses, financial losses brought about by time losses of the injured ones,

medical expenses, damage to property and plant and equipment are those more obvious ones. The huge cost due to a poor safety record, as suggested by Lingard and Rowlinson (1991), will eventually be reflected in a contractor's balance sheet. Arnold (1999) mentions that accidents cost businesses a great deal of money in down-time, lost productivity, retraining and even penalties.

Direct Costs

Direct costs, according to Hinze's (1997) definition, are those directly attributed to or associated with injuries. They are typically the costs covered by employees' compensation insurance policies. The direct costs of injuries tend to be those associated with the treatment of the injury and any unique compensation offered to workers as a consequence of being injured. Everett *et al* (1996) define direct costs as "those actual, contractor cash flows that can be directly attributable to injuries and fatalities". Such costs can be reasonably well-predicted or measured. Kennedy (1997) gives two examples of direct cost, they are medical expenses and worker's compensation. Rowlinson (1997) itemizes the direct costs of accidents more comprehensively and they are the followings:

- sick pay;
- employees' compensation payments;
- personal injury claims;
- repair of damage to buildings;
- repair of damage to buildings;
- repair of damage to plant and equipment;
- replacement of products; and
- overtime payments.

Hinze and Appelgate (1992) say that direct costs of injuries are typically referred to as insurable costs, since they can be insured against, and thus can be quantified with reasonable accuracy.

Rowlinson (1997) further classifies insured costs into three categories, which can all be insured against. They are employers' liability, public or third party liability and

contractors' all risks policies. The employees compensation system in Hong Kong is compulsory. An employer must be in possession of a valid insurance policy to cover his liabilities to their employees in case of any accidents arising out of and in the course of employment or an occupational disease. This is compulsory for employers in Hong Kong and is directly related to safety at work. Public and third-party liabilities can also be related to site safety issues and these risks would generally be insured against. Contractors all risks insurance deals with risks that may occur during the construction process, such as a fire on-site which may destroy parts of the constructed works. Contractor would be covered by the policy to put the works back to the condition they were in before the incident took place.

Indirect Costs

Besides the direct costs of accident, which are easily identifiable, Everett *et al* (1996) say there are less tangible costs incurred in case of an accident. These costs will be referred to indirect costs and are not insurable. According to Hinze and Appelgate (1992), indirect costs are much more elusive to identification and particularly quantification. All non-insurable costs incurred from an injury can be regarded as indirect costs.

Many authors have identified indirect costs. Heinrich (1941) provides a comprehensive list of them:

- cost of lost time of injured employee;
- cost of time lost by other employees who stop work;
- cost of time lost by foremen, supervisors or other executives;
- cost of time spent on the case by first aid attendant and other staff;
- cost due to damage to machinery, tools, property and materials;
- incidental cost due to interference with production;
- cost to employer for continuing wages of injured worker;
- cost due to loss in profit due to reduced worker productivity ;
- cost due to loss in profit due to idle equipment;
- cost incurred because of subsequent injuries partially caused by the incident; and
- cost of overheads (utilities, heat, rent, etc).

Levitt and Samelson (1993) identify some more indirect costs, they include interest payment due to the delayed completion, cost to reschedule work and fines in case of prosecution and so on. Hinze and Appelgate (1992) point out that the indirect jobsite costs of worker injuries begin with costs attributable to the injured worker. At the time of the injury, and shortly after that, the injured worker will continue to be paid regular wages even though no productive work is actually performed. Subsequent to the day of the injury, the worker may return to work at a lower productivity level, increasing the costs of construction. Costs of transporting the injured to hospital are directly related to each injury. Workers or site personnel may stop to help the injured worker right after the accident, this is also contributable to indirect costs.

Many people suggest that indirect costs are the major component of all accident costs. In order to calculate the indirect costs, which is so elusive as suggested, an indirect cost multiplier range from 2 to 20 times will be used to multiply the direct costs (Usmen 1994). Heinrich (1941) says 4 is most commonly used. Hinze (1994) holds similar idea that the total indirect costs tend to more than double the direct costs when liability claims are taken into account.

All the above studies show that accident costs are much far-reaching than just hospitalization and compensation of the injured party. Different parties have used various analogies to illustrate the ratio of direct and indirect accident costs and different types of accidents. Heinrich *et al* (1980) uses the cost iceberg as shown in figure 3.1 to illustrate the relationship between direct and indirect accident costs. Direct costs (known as insurable) and indirect costs (known as uninsurable) can be described as the protruding part and hidden part of an iceberg. This is known as the cost iceberg. Direct costs of accident are just the protruding part of the iceberg, which is much smaller than the hidden part. Some used the accident triangle to illustrate accident ratios. The study finds out that only 1 accident which required a worker to stay away from work for more than three days. More than 50 minor injuries required first aid treatment only and more than 3,500 non-injury incidents could have turned into minor or major injuries.

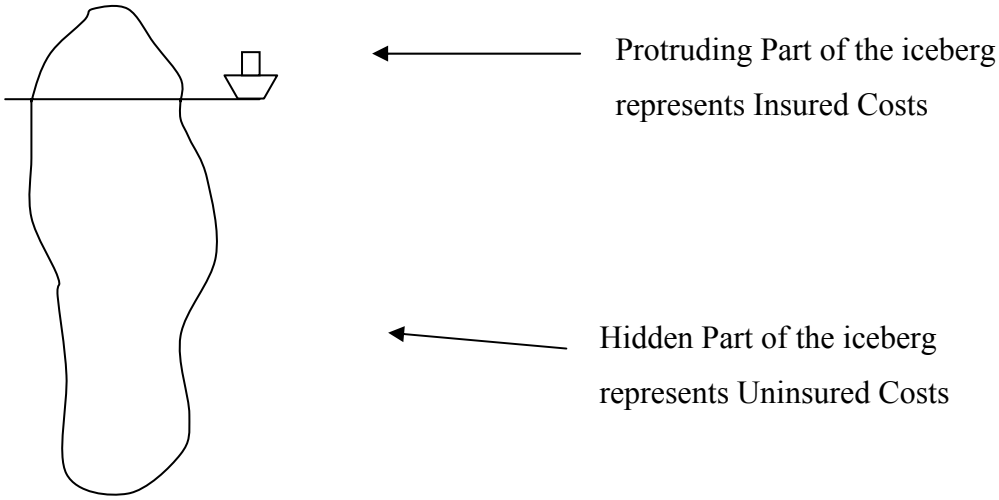

Fig. 3.1 Cost Iceberg

(Source: Heinrich)

Intangible Costs

Bifulco (2001) regards intangible costs as costs that cannot be quantified. Examples include adverse public relations and negative public perceptions related to significant accidents, and lost opportunities due to the growing tendency for owners to prequalify contractors based on past safety performance. Hinze (1997) groups these costs as the followings:

- pain and suffering of the injured worker;
- adverse effects of the injury on other family members;
- damage to the company image; and
- reduced morale of company employees.

Actually, the elements identified by Bifulco (2001) and Hinze (1997) are related. Accidents will undoubtedly retard the company image, whittling down its profit margin and competitiveness. Poor accident performance will also deprive the company from successfully bidding a tender, or worse, the firm will not be prequalified by the owners. Injury or death may shake employees' morale, thus reducing productivity. Dickens (2005) also agrees that jobsite safety is something that cannot be neglected as it is an issue that affects a team's health, morale and productivity.

De Saram and Tang (2004) carries out an extensive study to investigate the pain, suffering costs and loss of enjoyment of life (non-material losses) of the victims of construction accidents in Hong Kong between 1999 and 2003. It is found that the average percentage of compensation awarded for non-material damages during that period is about 30%.

Safety Costs

Total costs of accidents on a building site depend greatly on project safety performance (Tang and Wong, 1995). As stated by Tang *et al* (1995), safety investment is generally aimed at protecting the health and physical integrity of the workers and the material assets of the contractor. That means contractors have to invest resources, such as money, time, effort in order to provide a safe working environment.

Three major investment components are included in safety investment by Tang *et al* (1995) and they are safety administration personnel, safety equipment, and safety training and promotion. Salaries of safety administration personnel, like site staff and head office staff are included in the investment to safety administration personnel. Safety equipment investment includes purchasing of safety equipment that has to do with the provision of safety on building sites. Safety training and promotion investment are money spent on organizing safety training courses and safety promotion.

Safety performance varies with the amount of safety investment in the project. Theoretically, the more money is invested in safety, the better safety performance will be. However, the amount of safety investment could not be unlimited, how much should be invested most effectively so as to minimize accident on site?

Tang *et al* (1995) carry out a comprehensive study on the safety cost optimization. They think that building contractors should increase their safety investments in their construction projects since better safety performance can be brought about by higher safety investment. They use a dimensionless quantity, the accident loss ratio (ALR) to compare site accident costs of projects of different contract sums and carried out in

different time, so as to eliminate the effect of inflation. ALR is defined as the ratio of total costs of site accidents in a project to the contract sum, expressed in percentage. Another dimensionless quantity, the safety investment ratio (SIR), is introduced to contrast the safety investments on projects of different sizes and of different time. SIR is defined as the ratio of total safety investment in a project to contract sum, also expressed in percentage. By adding ALR and SIR curves, total costs ratio versus safety performance can be obtained. The minimum of this combined curve reflects the optimal safety investment of a building project.

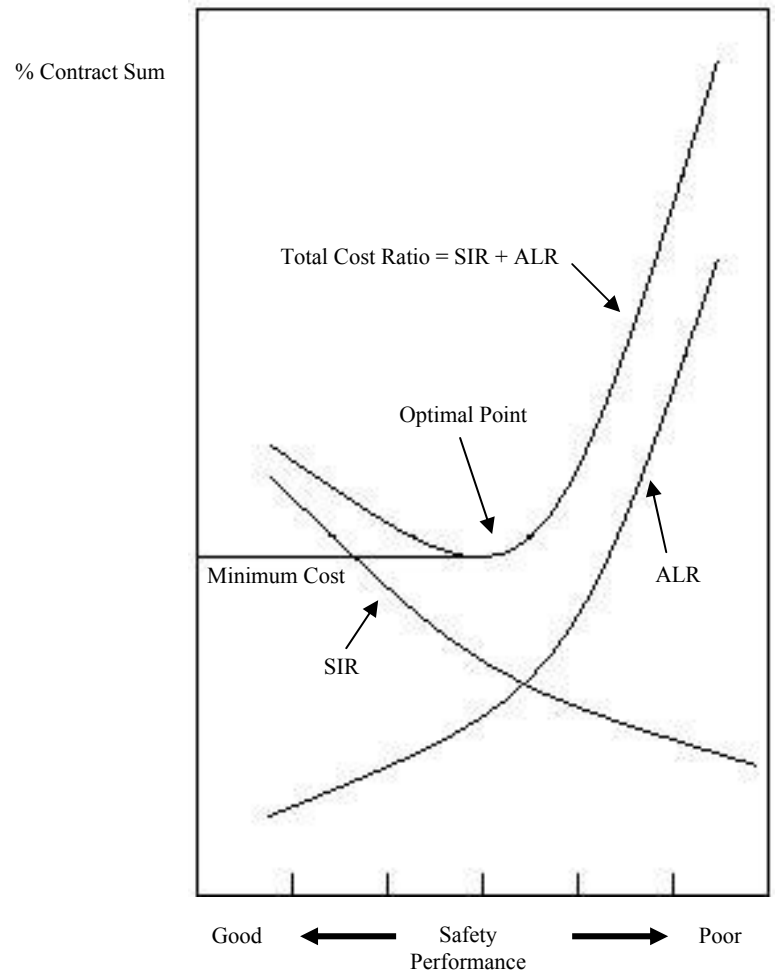

Fig. 3.2 Total Costs VS Safety Performance

(Source: Tang et al 1995)

After analyzing the data collected from four different building contractors, the optimal safety investment on a building project and the total cost to the contractor (accident loss + safety investment) are found to be about 0.6% and 0.82% of the contract sum respectively. Tang *et al* (1995) highlight that 0.6% should be regarded as the minimum amount of

safety investment in a building project. Any investment greater than this amount could bring along intangible benefits, such as greater peace of mind of workers, better reputation of the company, greater job satisfaction and so on.

However, this study excludes less serious accidents, such as first-aid-only accidents and non-injury accidents, as the records of such accidents are not available from contractors in the territory. These accidents may contribute a considerable amount of accident costs as they may cause damage to equipment, material or finished works. The optimal safety investment will also be pushed higher by an increased ALR. This responds with what Tang *et al* (1995) suggests "*the 0.6% should be regarded as a* ***minimum*** *amount of safety investment in a building project*".

Summary

Costs of accidents can be divided into direct, indirect and intangible and they can be summed up as below:

Direct Costs	Indirect Costs	Intangible Costs
○ Sick pay ○ Employees' compensation payments ○ Personal injury claims ○ Public liability claims ○ Property losses ○ Repair of damage to plant and equipment ○ Replacement of products ○ Overtime payments	○ Costs of wages paid for lost time by the injured and not injured workers ○ Reduction in productivity ○ Disruption to schedule ○ Cost due to overtime procedures necessitated by the accident ○ Cost of time lost by field management ○ Cost of wage and benefit due to decreased output of injured worker after return to duty ○ Cost of training replacement personnel ○ Cost of administrative time	○ Pain and suffering of the injured worker ○ Adverse effects of the injury on other family members ○ Damage to the company image ○ Reduced morale of company employees

	spent on investigations and reports of accident o Long term effects of injuries on employee morale o Damage to contractor's image o Increased insurance premiums o Cost due to loss in profit due to idle equipment o Time spent with legal proceedings	

Table 3.1 Summary of Accident Costs

Accident costs are wide reaching and it can be very costly to the company and the society. It is therefore important and wise to invest on safety so as to provide a safety working environment, which can no only protect the lives of workers, but also reduce the costs incurred by accidents.

Chapter 4 Factories and Industrial Undertakings (Safety Management) Regulation

Introduction to Safety Management System

Safety management systems are not new to Hong Kong. Many have been written on it. Rowlinson (1997) regards site safety as an integral part of the project objective and safety attitudes a part of the project culture in order to pursue site safety effectively. Management at head office and on-site must be seen to care. Only then, an effective and committed safety officer will be appointed and given sufficient call on time and resources to achieve site safety.

According to the Labour Department, below are the objectives of setting up a safety management system:

1. **to prevent improper behaviour that may lead to accidents;**
2. **to ensure that problems are detected and reported; and**
3. **to ensure that accidents are reported and handled properly.**

Leung (1995) defines a safety management system as organizational arrangements within a company which will facilitate the proprietor to identify hazards at work and target resources and efforts to eliminate such hazards. He pointed out that conventional enforcement approach has many drawbacks. The biggest drawback he identified is that enforcement does not help to build up a safety culture among the employers and workers and bring about long term improvements to the safety standards. Thus a self-regulating system of safety management is believed to be useful in cultivating a safety culture among the proprietors and their workforce and hence self-regulation.

Leung (1995) also points out several advantages a safety management system has over the enforcement approach. Employers and workers are closely involved in devising the safety policy for and monitoring the safety measures in a safety management system. Thus, there will be greater awareness of and incentive for compliance with industrial

safety among all concerned. The development of safety culture in workplace is believed to contribute most significantly to the reduction in industrial accidents in long run.

Besides, a safety management system enables flexibility of developing safety policies and measures most suitable to the particular circumstances of individual companies. The inputs from employer and employees make the safety management processes more readily be modified to keep pace with changing circumstances.

Occupational Safety and Health Council (OSHC) (2000) publishes a book, guiding organizations to establish its occupational safety management system. It is mentioned in the guidelines that safety management system can also grasp the following advantages:

- reduce the risks to the employees and other people;
- increase the efficiency of the business operations; and
- help the organization to build a responsible image.

An effective safety management system can be used to manage and control both existing and potential hazards and its effectiveness can be maximized when an organization is able to combine occupational safety and health issues into its business strategy.

The Factories and Industrial Undertakings (Safety Management) Regulation

In 1995, the Hong Kong government published a consultation paper on the review of industrial safety in Hong Kong. It was recommended that the government should shift its strategy of dealing with safety from enforcement of legislation to self-regulation by implementing safety management system. The paper reported that many overseas countries like Australia and Singapore had adopted safety management within companies in their attempts to resolve the problem of workplace accidents and there were significant improvements in their safety standards and decline in the accident rates over the years.

The government thinks that the primary responsibility of safety at work rests with the contractors and workers, who create the risks and those who work with such risks.

The goal of safety management is to attain long-term improvements in safety standards and introduce self-regulation by the contractors and their workers. In November 1999, the Legislative Council approved the Factories and Industrial Undertakings (Safety Management) Regulation, and it came into effect in April 2002 to provide a legislative framework within which self-regulation is to be achieved through a company system of safety management.

From the Guide to the Factories and Industrial Undertakings (Safety Management) Regulation published by the government, the Regulation provides for the introduction of a safety management system in selected industrial undertakings, such as construction sites.

Contractors who are regulated by this regulation are defined as below:

A contractor in relation to construction work having:

- *an aggregate of 100 or more workers in a day working in a single construction site or a contractor in relation to construction work with a contract value of $100 million or more;*
- *an aggregate of 50 or more but less than 100 workers in a day working in a single construction site;*
- *an aggregate of 100 or more workers in a day working in 2 or more construction sites;*
- *an aggregate of 50 or more but less than 100 workers in a day working in 2 or more construction sites.*

Such contractors are required, under the regulation, to adopt safety management system. Schedule 4 of the regulation defined the 14 elements of a safety management system which contractors have to include. They can be divided into three parts:

Part I

1. *A safety policy which states the commitment of the proprietor or contractor to safety and health at work.*
2. *A structure to assure implementation of the commitment to safety and health at work.*

3. *Training to equip personnel with knowledge to work safely and without risk to health.*
4. *In-house safety rules to provide instruction for achieving safety management objectives.*
5. *A programme of inspection to identify hazardous conditions and for the rectification of any such conditions at regular intervals or as appropriate.*
6. *A programme to identify hazardous exposure or the risk of such exposure to the workers and to provide suitable personal protective equipment as a last resort where engineering control methods are not feasible.*
7. *Investigation of accidents or incidents to find out the cause of any accident or incident and to develop prompt arrangements to prevent recurrence.*
8. *Emergency preparedness to develop, communicate and execute plans prescribing the effective management of emergency situations.*

Part II

1. *Evaluation, selection and control of sub-contractors to ensure that sub-contractors are fully aware of their safety obligations and are in fact meeting them.*
2. *Safety committees.*

Part III

1. *Evaluation of job related hazards or potential hazards and development of safety procedures.*
2. *Promotion, development and maintenance of safety and health awareness in a workplace.*
3. *A programme for accident control and elimination of hazards before exposing workers to any adverse work environment.*
4. *A programme to protect workers from occupational health hazards.*

As stated by Rowlinson (2003), Part II of the above items must be provided and the third part should be provided. This regulation has brought about the biggest change in the way that contractors are expected to organize themselves. Under this regulation, contractors are required to have safety management systems, a safety policy and a safety committee.

Contractors are also required by the law to conduct safety audits or safety reviews of their systems and this will be discussed in detail in the following section.

Introduction to Safety Audit

Having a safety management system is not the end to construction safety. Such safety management system has to be reviewed from time to time so that the system could be kept up-to-date and effective. Eves (1993) and Rowlinson (2003) both recognize that all control systems deteriorate over time and become obsolete as a result of changes within and outside the organization. Thus auditing, which can identify deficiencies before they result in losses, is necessary. Under the Regulation (Cap 59 AF, 16), safety audit of the safety management systems is required. To begin with, definitions of safety audits given by different parties will be introduced first.

Safety Audit, as mentioned by the Safety and Health Practitioner (1994), is a formalized documented system designed to determine the effectiveness of the company's safety system. It is needed to assure that necessary safety culture is in place to comply with legislation and be able to protect employees and ensure that all of the operations for which it is responsible are safe.

Pang (1995) identifies the similarities between management of safety and quality. Quality Audit is a scrutiny process before a company can obtain ISO 9000 certificate. While safety audit is a similar procedure with emphasis on the effectiveness and efficiency of a safety and health management system. He quoted the definition of auditing given by the Health and Safety Executive:

> *"a structured process of collecting independent information on the efficiency, effectiveness and reliability of the total safety management system and draw up plans for corrective action."*

He further induced that safety audit must be systematic and repeatable process carried out by auditors who must be non-biased and preferably an outsider. There must be a developed management system in existence, so that recommendation in form of an action plan on the safety system could be given.

Safety auditing is defined by the Organization for Economic Cooperation and Development (1992) as a methodical in-depth examination of all or part of a total operating system with relevance to safety. It involves planned and documented activity performed in accordance with written procedures, to verify, by examination and the evaluation of objective evidence, that the appropriate elements of a health and safety management system have been developed, documented and implemented.

Rowlinson (2003) points out that the objective of auditing is to monitor the performance of safety systems. Auditing aims to provide an independent assessment of the management, planning and control systems so that deficiencies in these can be identified before they result in losses.

Other than the elements to be processed by safety management system, it is also required under the Factories and Industrial Undertakings (Safety Management) Regulation that construction projects with 100 or more works and projects with a contract value of $100 million or more have to carry out safety audits of their safety management system.

When to Introduce Safety Auditing

According to Pang (1995), safety auditing can be used in many ways. However, to him, the best time to introduce safety audit is when everyone seems to be satisfied with the existing management system and beginning to take it for granted. At this point, management may face the following problems:

1) lack of interest,
2) running out of innovative ideas, and
3) losing momentum in safety movement.

He describes safety management system as the spirit of ISO9000. Obtaining the certificate is not the end of the story, it is important to maintain it so that the system can be kept up-to-date. Therefore, audit is most effective tool to maintain the system, promote interest and to inject new ideas from external auditors with fresh pairs of eyes and ears.

Role of Safety Auditor

According to the Safety and Health Practitioner (1994), auditors, who should be trained and competent health and safety professionals, have the responsibility to conduct safety audit. Safety auditors may or may not be part of the organization, but most importantly, he or she should be impartial.

Auditors should conduct the audit objectively by looking at the documented records as evidence of the performance of the systems in order to achieve a successful audit.

Safety Audits under the Law

Under the law, contractor shall appoint a registered safety auditor to conduct a safety audit in the construction industry. Such contractor shall ensure that safety audits of construction work are conducted not less than once in each six months period. The contractor who has appointed a registered safety auditor to conduct a safety audit shall first provide all such assistance, facilities and information as may be necessary for the audit. Secondly, as required by the law, if the auditor is an employee of the contractor, the auditor is not required to carry out other work of a nature or to the extent that would prevent the efficacious conduct of the audit. Under section 15 of the Safety Management Regulation, safety auditor has to submit an audit report to the contract within 28 days after completing the audit. The contractor after receiving the audit report just mentioned, shall first read and countersign the report, and record the date of his countersignature, as soon as practicable after receiving the report. Besides, if the report contains recommendations for improvements to the safety management system to which it relates, the contractor shall draw up a plan for the improvements within 14 days after receiving the report and implement the plan as soon as possible. Finally, if such plan is drawn up, the contractor shall submit a copy of the plan to the Commissioner within 21 days after receiving the report.

Summary

The Safety Management Regulation is enacted to govern construction sites having more than 50 workers. It aims at establishing self-regulation by setting up safety management

system by contractors. It is believed that accident rate can be brought down by developing a safety culture in the construction industry.

The objectives of a safety management system as mentioned by the Labour Department are to prevent improper behaviour that may lead to accidents, to ensure that problems are detected and reported and to ensure that accidents are reported and handled properly. Besides achieving the abovementioned objectives, a safety management system will not be successful and effective without proper safety audit which reviews the system from time to time.

Chapter 5 Methodology

Research Objectives

There are numerous researches on matters relevant to construction safety performance in Hong Kong. To name a few, they included studies on accident costs, factors leading to construction accidents, which have also been discussed in previous chapters, and also advantages of implementing safety management system before it has became mandatory under Factories and Industrial Undertakings (Safety Management) Regulations in 2002. This dissertation aims at finding out the effectiveness of safety management system after the Safety Management Regulation took effect. Besides, this research also aims at finding out whether there are any differences in its effectiveness between building works and civil works in Hong Kong's construction industry as it is suggested by literatures (Lee, 1991) and news that the working environment and job nature of building works and civil works are quite different. The enactment of the Factories and Industrial Undertakings (Safety Management) Regulation has come to its fourth year, therefore it is a right time to review the effectiveness of safety management system in Hong Kong's construction industry under this regulation.

In this study, detailed questionnaire are distributed and interviews are conducted to achieve the following objectives. The objectives can be summarized as shown below:

i. To understand the background information of construction safety, including regulations, policies, measures and so on.
ii. To identify factors causing construction accidents in recent years.
iii. To study the impacts of the Safety Management Regulation on construction safety.
iv. To evaluate the effectiveness of safety management system, in building works and civil works respectively, after it has become mandatory under the Factories and Industries Undertakings (Safety Management) Regulations.

Questionnaire and Interview Survey

This dissertation aims at collecting the industry's opinion on the effectiveness of the safety management system and achieving the above 4 objectives. Two similar questionnaires (one for building works and one for civil works, both are identical in content) were sent to safety officers, safety managers and project managers working for main contractors in Hong Kong. Safety officers are the staff employed by construction contractors to assist contractors in promoting the safety and health of employers. Project managers are assuming a managerial role, governing the construction works. Safety managers have dual roles to play in regards of promoting safety and managerial works. These parties are targeted to fill the questionnaires and to be interviewed in the second stage of data collection as they would have a direct relation to the safety on construction sites.

There are three benefits in using questionnaire survey in the first phase of data collection. Firstly it is because distributing questionnaires is an efficient way to gather information in a comparatively short period of time. The data obtained can be readily used in statistical analysis. Secondly, even though not all construction companies can be surveyed, the data gathered from the sample can be reflective of the opinion of the population. Last but not lease, follow-up interviews can be arranged by inviting questionnaires respondents to provide their contact number. Data gathered in the questionnaire survey can become a basis for further investigation in subsequent interviews.

Conducting interviews after questionnaires are collected is beneficial too. It is because interviews could be structured to complement the inadequacies of the data collected from the questionnaires. Interviewees could also be asked their comment to the rankings derived from the replied questionnaires. More detailed information could be obtained by asking from the interviewees directly.

The purpose of having two identical questionnaires is to find out the effectiveness ranking for building works and civil works respectively. It can be found from previous news that most of the construction accidents resulted from fall from height. Most of such accidents usually lead to serious injuries or fatalities, contributing 47% of the fatalities in the

industry in 2004. The chance of working at height for building works is larger than that of civil works as buildings in Hong Kong are mostly high-rise.

The respondents were required to rank the effectiveness of nineteen factors which can potentially be improved by safety management system by ticking how much they think the system of their companies is effective. Among these nineteen items, three of them are the objectives of setting up a safety management system as stated by the Labour Department. The ranking of the nineteen factors could be obtained by using an effectiveness index as shown on page 46, which will be explained in detail later. From the ranking, the effectiveness for the safety management system in improving the nineteen items could be found. If it is found that the three objectives stated by the Labour Department have high rankings, the safety management system can said to be effective by achieving its objectives.

At the end of the questionnaires, the respondents were invited to leave their name and contact numbers if they wish to. This is for the purpose of clarifying the response in the questionnaires and also to invite them for an interview. Finally, the nineteen factors can be ranked according to how they effective they are being improved by the safety management system. At last, three structured interviews were conducted with safety managers. It is expected that the interviews can provide more detail information the effectiveness of safety management system and to supplement for the inadequacy of the questionnaire. The samples of the questionnaires can be found in Appendix I and II respectively.

Questionnaire

Targeted Respondents

120 construction companies involving new construction works in Hong Kong were sent with each of the two abovementioned questionnaires. These are Group B and Group C contractors chosen from the "List of Approved Contractors for Public Works" in the Hong Kong Builder Directory 2005 37th Edition. Group B contractors have contracts of value up to $50 million and Group C contractors have contracts of value exceeding $50 million. These companies are selected because they are mostly main contractors and

involve in new construction work in the territory. However, small contractors are not considered in this study as they do not usually involve in new works, but mainly Addition and Alteration works and site formation works. The questionnaires were sent to the safety officers, project managers and project managers in these companies. It is because they are usually the managerial staff on site and have a first-hand experience to site safety performance since they work on site. Thus they will know more about the safety management system. At the end of the questionnaire, respondents were required to express their willingness to have a face-to-face interview by ticking "Yes" or "No". Therefore, the targeted interviewees are part of the targeted respondents of the questionnaires.

Identification of the nineteen items in Questionnaires

Previous researches point out numerous of negative effects for not having satisfactory construction safety performance and the causes of poor construction safety performance. These items are identified after reviewing different literatures in previous chapters of this dissertation. They are included in the questionnaire to find out how much they can be improved by the safety management system. For item 3, 8 and 13, they are the objectives of establishing a safety management system as stated by the Labour Department.

Nineteen items, including the three objectives, which can potentially be improved or achieved by implementing a safety management system, are shown below. These items can be classified into five categories:

Improvement in Workers' Performance

1. Increase in workers' morale
2. Improvement in workers' awareness towards site safety
3. *Improvement in workers' behaviour that may lead to accidents*

Reduction in Accident Costs

4. Reduction in employees compensation
5. Reduction in damages to equipment and tools
6. Reduction in insurance premium

7. Reduction in indirect costs, such as cost of time lost by foremen, supervisor or other executives in helping or investigating accidents

Improvement in Project Performance

8. *More hazards or problems which may lead to accidents are detected and reported*
9. Reduction in minor accidents which did not lead to injury
10. Reduction in accidents which lead to injury
11. Reduction in day losses due to accidents
12. Reduction in project duration due to fewer accidents
13. *Improvement in accident-reporting process*

Improvement In Company's Performance

14. Improvement in company's image, e.g. winning in safety competitions
15. Improvement in company's competitiveness in bidding

Improvement in Project Management

16. More control over subcontractors (in term of site safety)
17. Better house-keeping
18. Closer supervision of the workers
19. Better communication about safety on job visits by top managers

To explain item 3, 8 and 13, we have to look at the three objectives in setting up a safety management system as stated by the Labour Department, they are:

1. *to prevent improper behaviour that may lead to accidents;*
2. *to ensure that problems are detected and reported; and*
3. *to ensure that accidents are reported and handled properly*

If a safety management system is successful or effective, its objectives of implementing could be achieved and have a high scoring. Item 3 - Improvement *in workers' behaviour that may lead to accidents* is representing the first objective – *to prevent improper behaviour that may lead to accidents*, item 8 – *More hazards or problems which may lead to accidents are detected and reported* is representing the second objective – to ensure that problems are detected and reported and item 13 – *Improvement in accident-reporting process* is representing the last objective – *to ensure that accidents are reported and*

handled properly. These three items are the italic points among the nineteen items shown above. This explains the reasons for having item 3, 8 and 13.

Besides, there are two more questions at the end of the questionnaires, they are:

20. In general, Factories and Industrial Undertakings (Safety Management) Regulation is effective in leading to a safer building-/ civil-work sites of your company.
21. In general, Factories and Industrial Undertakings (Safety Management) Regulation is effective in building up a safety culture in your company.

The purpose of these two questions is to find out the respondents view on the effectiveness of the Factories and Industrial Undertakings (Safety Management) Regulation in leading to safer work sites and building up a safety culture in the company. In the other words, the respondents' perceptions on the effectiveness of their safety management system are asked after it has become mandatory under the law. Therefore, the questionnaire is constitutes of twenty-one items in total.

Processing of Data

Respondents are required to rank "Very Effective", "Effective", "Slightly Effective" and "Not Effective" for each of the nineteen items according to the effectiveness of the safety management system in improving them. For items 20 and 21, respondents are required to show how much they agree with the statement by ranking "Strongly Agree", "Agree", "Slightly Agree" and "Do Not Agree". Each of this rank is allocated with a weight for calculating the ranking of the nineteen factors and the weight decreases with the effectiveness of the first nineteen factors and the degree of agree of question 20 and 21. Calculation can be done by taking the following steps:

$$\text{Effectiveness Index of each factor} = \frac{\sum_{i=1}^{4}(a_i \times X_i)}{4} \times 100$$

where,

a_i = constant expressing the weight to the i^{th} rank factor

i = 1,2,3,4

weight for the first rank motive = a_1 = 4

weight for the second rank motive = a_2 = 3

weight for the third rank motive = a_3 = 2

weight for the fourth rank motive = a_4 = 1

$X_i = n_i / N$

n_i = the variable expressing the frequency of the i^{th} rank factor

n_1 = Frequency of the first rank motive

n_2 = Frequency of the second rank motive

n_3 = Frequency of the third rank motive

n_4 = Frequency of the fourth rank motive

N = Total number of responses

The index is used to find a ranking of the factors that could be potentially improved by safety management system under Factories and Industrial Undertakings (Safety Management) Regulation. The factor with highest index is the most-improved factor and vice versa.

After processing the data with the effectiveness index, the rankings of the nineteen factors for the two types of construction works are tested with Spearman's rank correlation test to test whether the opinions of the building works and civil works are correlated. Ashcroft and Pereira (2003) regard Spearman's rank correlation coefficient as a non-parametric test based on ranks which is appropriate for ordinal or ranked data. Therefore this test is adopted for this study where two rankings are generated. A Spearman's rank correlation coefficient, r_s, is calculated for the two rankings. This coefficient, ranges in value from -1 to +1, can be used to provide a numerical index of the relation between the two rankings of factors. Positive sign reflects that high ranks in one distribution tend to be associated with high ranks in the other distribution and vice versa. The degree of agreement of the two rankings is determined by the numerical value of the coefficient.

The Spearman's rank correlation coefficient is calculated by equation below:

$$r_s = 1 - \frac{6\sum D^2}{F(F^2 - 1)}$$

where:
D = Difference between ranks for the same factor of the two rankings
F = Number of factors (in this case 19)

The critical value r_s can be used to test the alternative hypothesis that the two types of works generally agree on the important ranking of the factors against the null hypothesis which says that there is no association between the rank pairs that r_s assumes a large value is solely to chance. From the table of critical value of Spearman's rank correlation coefficient, the critical value of r_s with $\alpha = 0.05$ and F = 19 is 0.388. The null hypothesis is rejected if r_s of the two rankings is found to be larger than the critical value and it can be concluded that the rankings for building construction and civil construction works agree with each other.

Interview

Interview is the second stage of data collection. They were carried out after the rankings were generated from the replies of the questionnaires. There are three objectives to be achieved by interviewing the respondents of the questionnaires and they include the followings:

1. To further investigate the performance of safety management system under building works and civil works.
2. To obtain professionals' opinions on the safety management system before and after the enactment of Factories and Industrial Undertakings (Safety Management) Regulation.
3. To obtain subjective opinions from safety professionals so as to supplement the questionnaire results.

The interview questions consist of seven questions. These questions are mainly about three sections, they are i) Comparison Between Building and Civil Works, ii) Comparison Before and After the Enactment of Legislation and iii) Success and Worthiness of safety management system in General. Sample of interview questions could be found in Appendix III.

The two questions in the first section, “Comparison Between Building and Civil Works”, are designed to achieve the first objective. The second objective could be achieved by the two questions in the second section “Comparison Before and After the Enactment of Legislation”. The last section “Success and Worthiness of Safety Management of safety management system in General” aims at finding out how safety professionals think the effectiveness of safety management system that is to achieve the third objective stated above.

Chapter 6 Data Presentation and Analysis

The research was conducted from November 2005 to March 2006 and aimed at finding out the effectiveness of safety management system of construction firms after the enactment of the Factories and Industrial (Undertakings) Regulation from the perspective of safety officers, safety managers and project managers. It also intended to find out whether there is any difference in the safety management system for building works and civil works.

The results of the questionnaire will be first presented. This includes the background of the respondents, responding rate and the rankings generated by the equation of effectiveness index on Chapter 5 page 48. This is followed by the calculation of Spearman's rank correlation coefficient in order to find out whether the two rankings agree with each another. This chapter is ended with the discussion and analysis of the three interviews.

Results of Questionnaires

Response Rate

120 questionnaires sent to Group B and Group C contractors chosen from the "List of Approved Contractors for Public Works" in the Hong Kong Builder Directory 2005 37th Edition by mail. 28 replies from project managers, safety managers and safety officers were received. As a result, a general response rate of 23.3% was achieved.

However, since not all of the targeted companies participate in civil works, thus, the response rate for both types of works were different. There were 8 replies from civil construction works and 28 replies from building construction. Most of the respondents are safety managers, contributing about 60% of the respondents. The rest are safety officers and project managers sharing similar portion of respondents.

Duration of the establishment of Safety Management System

Since all the companies participate in building construction works, the duration of the establishment of safety management system can be viewed as a whole. Among the 28 responding companies, the proportion of respondents who have their safety management system established for zero to four years and five to ten years are the same, each contributed 29% of the respondents. 14% of these construction companies have set up the system for eleven to nineteen years. Only 11% of them have a safety management system which has existed for more than 20 years. The rest of the responding companies, about 18%, gave no response.

Costs of Setting up Management System

Among the 28 responding companies, only 10 of them, that is 36%, are willing to disclose the costs for setting up the safety management system. The costs range from HK$50,000 to HK$500,000, which is quite diverse.

Ranking of Factors to be improved by implementing Safety Management System

The nineteen factors listed on the questionnaires were ranked by using the equation of effectiveness index on Chapter 5 page 48. The followings show the ranking of the nineteen items of building works and civil works respectively with the three objectives stated by the Labour Department in italic fonts:

Ranking for Buildings Work

1. Improvement in company's image, e.g. winning in safety competitions – Cat. 4
1. Improvement in company's competitiveness in bidding – Cat. 4
3. *Improvement in accident-reporting process – Cat. 3*
4. Improvement in workers' awareness towards site safety – Cat. 1
5. *Improvement in workers' behaviour that may lead to accidents – Cat. 1*
6. Reduction in accidents which led to injury – Cat. 3
7. *More hazards or problems which may lead to accidents are detected and reported – Cat. 3*
7. Reduction in day losses due to accidents – Cat. 3

9. More control over subcontractors (in term of site safety) – Cat. 5
10. Reduction in minor accidents which did not lead to injury – Cat. 3
11. Better communication about safety on job visits by top managers – Cat. 5
12. Better House-keeping – Cat. 5
13. Increase in workers' morale – Cat. 1
14. Reduction in employees compensation – Cat. 2
15. Reduction in project duration due to fewer accidents – Cat. 3
16. Reduction in damages to equipment and tools – Cat. 2
16. Closer supervision of the workers –Cat. 5
18. Reduction in indirect costs, such as cost of time lost by foremen, supervisors or other executives in helping or investigating accidents – Cat. 2
19. Reduction in insurance premium – Cat. 2

Ranking for Civil Works

1. Improvement in company's image, e.g. winning in safety competitions – Cat. 4
1. Improvement in company's competitiveness in bidding – Cat. 4
3. *More hazards or problems which may lead to accidents are detected and reported – Cat. 3*
4. Improvement in workers' awareness towards site safety – Cat. 1
5. Increase in workers' morale – Cat. 1
5. *Improvement in workers' behaviour that may lead to accidents – Cat. 1*
5. Reduction in accidents which led to injury – Cat. 3
5. *Improvement in accident-reporting process – Cat. 3*
5. More control over subcontractors (in term of site safety) – Cat. 5
5. Better House-keeping – Cat. 5
11. Closer supervision of the workers – Cat. 5
11. Better communication about safety on job visits by top managers – Cat. 5
13. Reduction in minor accidents which did not lead to injury – Cat. 3
13. Reduction in day losses due to accidents – Cat. 3
15. Reduction in damages to equipment and tools – Cat. 2
15. Reduction in project duration due to fewer accidents – Cat. 3
17. Reduction in employees compensation – Cat. 2
17. Reduction in insurance premium – Cat. 2

17. Reduction in indirect costs, such as cost of time lost by foremen, supervisors or other executives in helping or investigating accidents – Cat. 2

Note:

Category 1 (Cat. 1)	=	Improvement in Worker's Performance
Category 2 (Cat. 2)	=	Reduction in Accident Costs
Category 3 (Cat. 3)	=	Improvement in Project Performance
Category 4 (Cat. 4)	=	Improvement in Company's Performance
Category 5 (Cat. 5)	=	Improvement in Project Management

General Opinions towards the Factories and Industrial Undertakings (Safety Management) Regulation

For the last two questions on the questionnaires, they were not processed by the effectiveness index as they are items independent of the rankings. These two questions aim to give a general picture on what the practitioners' opinions are towards the effectiveness of the regulations.

When asked to indicate the level of agree to the statement "In general, Factories and Industrial Undertakings (Safety Management) Regulation is effective in leading to safer building/ civil work sites of your company", 11% of the respondents of building works chose strongly agree, 64% of them chose agree, 18% of them chose slightly agree and 7% of them do not agree with the statement. For the result of civil works, no respondents strongly agree or do not agree with the statement. 7 out of 8 of them agree with the statement, which consists 87.5% of the respondents. While only 1 of them slightly agree with the statement, which resulted in 12.5%.

For the statement "In general, Factories and Industrial Undertakings (Safety Management) Regulation is effective in building up a safety culture in your company", only response of building works are considered. It is because all responding companies of civil works are also part of the respondents of building works. Otherwise, the sample size will be artificially boosted if responses from civil works are also taken into account. The percentages of respondents strongly agree and do not agree with this statement are the same, which is 4%. 61% of them agree with the statement and 32% slightly agree with it.

Results of Interviews

Respondents of the questionnaires were invited to put down their name and contact number if they wished to be interviewed. Among the 28 replies, three respondents were willing to grant an interview. Finally, three structured interviews were conducted in March 2006. Each of the interviews took about half an hour. seven questions were asked to find out further the performance of safety management system under building works and civil works and obtain practitioners' opinions on the safety management system before and after the enactment of the Factories and Industrial Undertakings (Safety Management) Regulation. Sample of interview questions can be found on Appendix III. The following introduced the background information of the company and the interviewee.

Interview 1

The first interview was conducted on 7 March 2006. As no consent was obtained from the interviewee, the name of the company and the interviewee will not be disclosed. The company which the interviewee works for belongs to Group C contractors in the category of buildings, port works roads and drainage, site formation and waterworks on the List of Approved Contractors for Public Works. The post of the interviewee is Safety Manager. This company has set up its own safety management system for about 6 years. For the sake of simplicity, the interviewee will be addressed as Mr. Li in the following parts of the dissertation.

Interview 2

The second interview was conducted on 16 March 2006. It was agreed with the interviewee, Mr. Chan, that only his surname will be disclosed but not the company he is working for. The company he is working for belongs to Group C contractors in the category of buildings under probationary status, Group B contractors in the category of roads and drainage and site formation works under probationary status on the List of Approved Contractors for Public Works. The post of the interviewee is Safety and

Environmental Manager. This company has set up its own safety management system for about 5 years.

Interview 3

The third interview was also conducted on 16 March 2006. Consent was obtained from the interviewee that interviewee's and his company's name could be disclosed here only for academic purposes. Mr. Kwan is the Senior Safety Manager working for Hip Hing Construction Company Limited. The company he is working for belongs to Group C contractors in the category of buildings and site formation works on the List of Approved Contractors for Public Works. The post of the interviewee is Senior Safety Manager. This company has set up its own safety management system for more than 10 years.

Data Analysis

Analysis of Questionnaires Results

Difference in Response Rate of Building and Civil Works Questionnaires

The difference in the figures between building works and civil works may be due to the job nature of the two types of construction works. Comparing with building works, civil works tend to be more complicated, thus large companies are more able to afford the plants and equipment for civil construction works. This is supported by the respondents of the civil works questionnaires. From the replies of civil works questionnaires, all of them are large constructing companies well-known in Hong Kong.

The Difference in Duration Which the Safety Management Systems Have Been Established

The Factories and Industrial (Undertakings) Regulation came into effect 4 years ago, which mean that, from April 2002 onwards, construction sites having more than 50 workers or construction projects with a contract value of $100 million or more have to implement safety management system. It can be shown from the questionnaires result that about 24% of the respondents have established safety management system for more than

10 years, long before the enactment of the legislation. These companies are mainly large companies which have already been established for a long time. Moreover, some of these companies usually have better safety performance than their counterparts. On the other hand, 32% of the responding companies have only set up such system for 4 years or less. They are usually smaller or less well-known construction companies. Their green safety management system may be due to contract value and the number of workers working on sites not falling within the requirement of the law previously. The reason for them to establish safety management system is to satisfy the law.

Differences and Similarities between the Rankings of Safety Management System for Building and Civil Works

Table 6.1 shows the rankings of benefits that could be brought by adopting safety management system in building construction projects and civil construction projects. It could be observed from the two rankings that, category 4 items (Improvement in Company's Performance) rank the top for both types of construction works, while category 2 items (Reduction in Accident Costs) rank generally low. Safety management system is not significant in reducing accident costs since category 2 items usually rank at the very bottom, but rather useful in improving the company's performance since category 4 items rank top for both types of works.

	Ranking for Building Works	**Effectiveness Index**	**Ranking for Civil Works**	**Effectiveness Index**
1	Improvement in company's image, e.g. winning in safety competitions – Cat. 4 Improvement in company's competitiveness in bidding – Cat. 4	72.22	Improvement in company's image, e.g. winning in safety competitions – Cat. 4 Improvement in company's competitiveness in bidding – Cat. 4	22.22
2				
3	*Improvement in accident-reporting process – Cat. 3*	70.37	*More hazards or problems which may lead to accidents are detected and reported – Cat. 3*	21.30
4	Improvement in workers' awareness towards site safety – Cat. 1	69.44	Improvement in workers' awareness towards site safety – Cat. 1	20.37
5	*Improvement in workers' behaviour that may lead to accidents – Cat. 1*	68.52	Increase in workers' morale – Cat. 1 *Improvement in workers' behaviour that may lead to accidents – Cat. 1* Reduction in accidents which led to injury – Cat. 3 *Improvement in accident-reporting process – Cat. 3* More control over subcontractors (in term of site safety) – Cat. 5 Better House-keeping – Cat. 5	19.44
6	Reduction in accidents which led to injury – Cat. 3	67.59		

7	Reduction in day losses due to accidents – Cat. 3 *More hazards or problems which may lead to accidents are detected and reported – Cat. 3*	66.67		
8				
9	More control over subcontractors (in term of site safety) – Cat. 5	65.74		
10	Reduction in minor accidents which did not lead to injury – Cat. 3	64.81		
11	Better communication about safety on job visits by top managers – Cat. 5	62.96	Closer supervision of the workers – Cat. 5 Better communication about safety on job visits by top managers – Cat. 5	18.52
12	Better House-keeping – Cat. 5	62.04		
13	Increase in workers' morale – Cat. 1	60.19	Reduction in minor accidents which did not lead to injury – Cat. 3 Reduction in day losses due to accidents – Cat. 3	17.59
14	Reduction in employees compensation – Cat. 2	57.41		
15	Reduction in project duration due to fewer accidents – Cat. 3	56.48	Reduction in damages to equipment and tools – Cat. 2 Reduction in project duration due to fewer accidents – Cat. 3	16.67
16	Reduction in damages to equipment and tools – Cat. 2	55.56		

	Closer supervision of the workers –Cat. 5			
17			Reduction in employees compensation – Cat. 2 Reduction in insurance premium – Cat. 2 Reduction in indirect costs, such as cost of time lost by foremen, supervisors or other executives in helping or investigating accidents – Cat. 2	
18	Reduction in indirect costs, such as cost of time lost by foremen, supervisors or other executives in helping or investigating accidents – Cat. 2	54.63		
19	Reduction in insurance premium – Cat. 2	52.78		

Table 6.1 Rankings for Building Works and Civil Works

Note:

Category 1 (Cat. 1) = Improvement in Worker's Performance
Category 2 (Cat. 2) = Reduction in Accident Costs
Category 3 (Cat. 3) = Improvement in Project Performance
Category 4 (Cat. 4) = Improvement in Company's Performance
Category 5 (Cat. 5) = Improvement in Project Management

It should be noted that, the three items in italic fonts, which are i) *Improvement in workers' behaviour that may lead to accidents – Cat. 1*, ii) *Improvement in accident-reporting process – Cat. 3* and iii) *More hazards or problems which may lead to accidents are detected and reported – Cat. 3*. It could be observed from table 6.1 that, "Improvement in accident-reporting process" ranks second and fifth in building and civil rankings respectively, "Improvement in workers' behaviour that may lead to accidents" ranks fifth in both types of works, and "More hazards or problems which may lead to accidents are detected and reported" rank seventh and third in building and civil works respectively. It can be concluded that the three objectives of setting up a safety management system have relatively high ranking.

The similarities and differences between the 2 rankings could be concluded in the tables below:

Rank in Building Works	Rank in Civil Works	
1	1	Improvement in Company's image
1	1	Improvement in Company's competitiveness in bidding
4	4	Improvement in workers' awareness towards site safety
5	5	*Improvement in workers' behaviour that may lead to accidents*
11	11	Better communication about safety on job visits by top managers
15	15	Reduction in project duration due to fewer accidents

Table 6.2 Items having the same ranks

Rank in Building Works	Rank in Civil Works	
3	5	*Improvement in accident-reporting process*
6	5	Reduction in accidents which led to injury
10	13	Reduction in minor accidents which did not lead to injury

14	17	Reduction in Employees Compensation
16	15	Reduction in damages to equipment and tools
18	17	Reduction in indirect costs
19	17	Reduction in insurance premium

Table 6.3 Items having similar ranks (Maximum 4 ranks different)

Rank in Building Works	Rank in Civil Works	
7	13	Reduction in day losses due to accidents
7	3	*More hazards or problems which may lead to accidents are detected and reported*
9	5	More control over subcontractors (in term of site safety)
12	5	Better House Keeping
13	5	Increase in workers' morale
16	11	Closer supervision of workers

Table 6.4 Items having diverse ranks

The correlation of the two rankings of the nineteen factors that could be improved by safety management system under building construction and civil construction projects are tested by the Spearman's rank correlation coefficient test using the equation on page 48 to find out whether the two rankings agree with each another.

It is found from the calculation that the difference between ranks for the same factor of the building works and civil works rankings is 197.5 and its Spearman's rank correlation coefficient r_s is +0.972. The null hypothesis is that the two rankings are not correlated and the large value of coefficient is just due to chances. With reference to the table of critical values of Spearman's rank correlation coefficient is 0.388 for nineteen factors. In this case, the coefficient is larger than the critical value, thus the null hypothesis can be rejected and it can be concluded that the respondents for the questionnaires of building works and civil works generally agree on the factors that could be improved by safety management system. The positive sign reflects that high ranks in the ranking for building works tend to be associated with high rank in the

ranking for civil works and vice versa. As the numerical value of the coefficient is 0.972, which is very close to 1, the degree of agreement of the two rankings is high.

The significance of the findings is that the safety management system under Factories and Industrial Undertakings (Safety Management) Regulation is something directional and most construction firms do not establish different safety management system for the two types of construction projects. Thus its effect on building works and civil works would not be very different. Besides, most of the questionnaires are filled by safety managers, who are in charge of the supervision of construction projects under their companies, therefore their viewpoints on the factors that could potentially be improved by safety management system under the two kinds of construction projects could be quite correlated. This points out that even the different in job and accident natures, the effect on building and civil construction projects are quite the same.

In the following, the rankings of each of the nineteen factors are discussed. Items with the same ranks are discussed first, followed by those ranked similarly (which have no more than 4 in difference in both ranks) and finally came the items which have diverse ranks.

Items Having the Same Ranks

Safety management system can be regarded as imposing the same effect on items having the same ranks on both types of projects.

Company's image is very important to every company. In Hong Kong's construction industry, developers outsource construction works of their development to main contractors and main contractors will further sub-contract the works to subcontractors. In order to successfully bid the works, many issues are considered other than submitting the lowest bid. One of the major considerations is past safety performance. This is especially true when main contractors are tendering for public works. Therefore, construction companies are willing to invest a lot to enhance their images. For example, they will take part very actively in safety competitions organized by different

organizations. These include the Construction Industry Safety Award Scheme jointly organized by the Labour Department, Occupational Safety and Health Council and Hong Kong Construction Association. Being awarded in these competitions could enhance company's image. Therefore, the improvement of company's image and competitiveness are very likely to draw top management level's attention and thus rank first in both building and civil works.

"Improvement in workers' awareness towards site safety" ranks the fourth in both types of construction projects, which can be regarded as high rank among the nineteen items. It is understandable because under the Factories and Industrial Undertakings (Safety Management) Regulation, elements including safety policy, safety training and in-house safety rules have to be adopted by main contractors. Such safety policy statement should be posted on notice board or circulated internally to the notice of all workers. Besides, contractors also have to investigate accidents or incidents to find out the cause of any accident or incident to develop prompt arrangements to prevent recurrence. This could also draw the workers' attention to the accidents and the causes behind them, so that they gain better knowledge on the accident causes and thus be more aware of site safety.

One of the three objectives of setting up safety management system - "*Improvement in workers' behaviour that may lead to accidents*" ranks the fifth, which can also be regarded as high rank among the nineteen factors. This is inter-related with the previous factors "Improvement in workers' awareness towards site safety". It is because after realizing the potential risks of not performing safely in construction site, their behaviour will change accordingly to avoid being the victims. However, it should be noted that, having adequate knowledge on construction safety does not imply the workers would behave accordingly. Generally speaking, the objective could be achieved significantly.

"Better communication about safety on job visits by top managers" came eleventh on both ranks. This implies that safety management system cannot effectively bring about an improvement in communication about safety on job visits by top managers. This

may perhaps be due to the heavy workload of top managers. Even if they could spare time visiting the sites, the frequency may not be high and the visits may not be regular enough to enhance communication. But it is an undeniable fact that communication could be bettered to certain extends by having top managers taking part in job visits or safety meetings. Thus, this factor situated a bit lower than the mid-point.

"Reduction in project duration due to fewer accidents" is the fifteenth on both ranks, indicating that project duration is not shortened even number of accidents reduced. Serious accidents which sometimes resulted in fatalities would suspend the project. Therefore, whether the project is shortened is affected by many factors. The reduction in number of accidents may not definitely reduce project duration if the accidents are serious.

Items Having Similar Ranks

Items having similar ranks refer to those items which differ in 4 or less ranks between the building works and civil works rankings. The effect of safety management system on these items can be regarded as quite the same in both types of works.

"*Improvement in accident-reporting process*" ranks the third and the fifth in building works and civil works respectively, which can be regarded as the several top-most factors. This item is actually one of the three objectives stated by the Labour Department in setting up safety management system. Safety management system can bring about this benefit significantly because in the fourteen elements, it is required to investigate accidents of incidents to find out the cause behind so as to prevent recurrence. This procedure includes reporting, recording and investigating accidents. This serves as a backbone for a more systematic accident-reporting process.

The sixth of building works ranking and the fifth of civil ranking is "Reduction in accidents which led to injury". This factor can be regarded as occupying a rather high position on ranks. Thus, the safety management system can reduce the number of injury significantly.

"Reduction in minor accidents which did not lead to injury" occupies the tenth and thirteen on building works rank and civil works rank respectively. These ranks tend to be below mean. In the other words, safety management system could not significantly improve this kind of minor accidents. It may be related to workers' attitude towards construction safety. They are taking risks of not being the victims in accidents. In this kind of accidents, as no injury is involved, workers will not actively take part in avoiding them. Therefore minor accidents not causing injury does not occupy a high position in both types of works.

"Reduction in Employees Compensation" does not occupy high ranks in both building works and civil works. This is rather unexpected because compensation to employees should decrease with the smaller number of accidents. However, it is found from the respondents that this is not the case. This may perhaps be due to the seriousness of accidents. Compensation could be huge if the accidents is serious, which involve incapability or fatality. Besides, employees' awareness to claim for compensation would affect this factor. Therefore, money spent on employees compensation does not rank high, implying it is not significantly improved by safety management system.

"Reduction in damages to equipment and tools" and "Reduction in indirect costs such as cost of time lost by foremen, supervisors or other executives in helping or investigating accidents" rank second last and last in both rankings for building works and civil works. These two factors both belong to category two, which is "Reduction in Accident Costs". Therefore, it can be said that, safety management system is not effective in bring down both direct costs and indirect cost.

Most respondents regard safety management system not effective in bringing down insurance premium. This may because even the accident rate has shown a downward trend in recent years, there are still some accidents which resulted in incapacities, serious injuries or fatalities from time to time. Compensation for these accidents, under Employees Compensation Ordinance, could be huge. Thus it comes last in both types of construction works.

Items Having Diverse Ranks

Items are regarded as having diverse ranks when the difference of their ranks between building works and civil works is greater than 4. For these items, it can be said that safety management system has different effects on them in building works projects and civil works project. Such difference can be resulted from the different natures of the two types of construction works.

"Reduction in day losses due to accidents" has diverse ranks in both types of works. It is the seventh in buildings works ranking and thirteenth in civil works ranking. Thus, it could be said that safety management system is more effective in bring about this benefit in building construction projects than in civil construction projects.

Even though "*More hazards or problems which may lead to accidents are detected and reported*" gets rather diverse ranks, seventh in building works and third in civil works, it situated at a rather top position on both ranks. Therefore, it can be said that, safety management system can achieve one of the objectives stated by the Labour Department more effectively on civil works sites than building works sites. But still, the system can achieve this objective significantly on both types of works.

There are more subcontractors' works in building works projects but more direct-employed workers in civil construction works. Subcontractors' workers are usually paid on daily-basis and thus have not strong sense of belonging to the main contractor. Therefore, they tend more to neglect the safety requirement on sites than main contractor's labour. This explained why "More control over subcontractors (in term of site safety)" ranks the ninth on buildings works ranking and fifth on civil works ranking.

Safety management system could provide clearer procedures and site inspections by safety officers. Therefore, "Better house keeping" could be expected to have high

rankings. However, it is only true in civil construction projects but not quite true in building construction works, its rank are the fifth and twelfth respectively.

The gap of "Increase in workers' morale" between the two types of works is very wide, it is the thirteenth in building works and fifth in civil works. This can also be explained by the nature of employment of workers in the two types of construction projects. As larger portion of workers in civil works projects are direct labour, they have a stronger sense of belonging to the main contractors than the subcontractors' workers. Having a stronger sense of belonging to the employer, their morale would be better than subcontractors' workers. This is coherent with many literatures about workers' morale, which can be found on Chapter 2.

As just mentioned, there are more subcontractors working in building construction sites than civil construction site. Subcontractors, who have weaker sense of belonging and less responsibility in safety, are more difficult to be controlled and supervised by main contractor. Therefore, "Closer supervision of workers" has higher rank in civil works (eleventh) than in building works (sixteenth).

Analysis of Interview 1

Background Information of the Safety Management System of the Company Before and After the legislation

The interviewee's, Mr. Li, company has established the safety management system for about six years. Before the enactment of the Safety Management Regulation, the company had something similar to a SMS. In the other words, its safety management system did not process all the fourteen items at that time. The reason for having such system was to satisfy the contract requirement of some clients, especially the public clients like the Housing Authority and Works Bureau. For example, it was required in the contract that main contractor should provide safety audit. To Mr. Li, the government acted as a pioneer in introducing safety management system to the industry. In private construction project, safety committee was formed sometimes. However, the items to be discussed are less detail.

Shortly before the enactment of the legislation, the company established its own safety management system. Other than being more comprehensive and all-rounded there are not many differences in the safety management system before and after the enactment of the Safety Management Regulation.

Comparison Between Building and Civil Works

According to Mr. Li, the job nature of building works and civil works are quite the same. Even though civil works are more complicated as they mainly involve construction of infrastructure, for example bridge and tunnel construction, the risk to safety is not actually greater. It is mainly because civil construction involves less work at height, which contributed to 14% of the construction accidents in 2004. However, it also contributed to 47% of the construction fatalities, which is very risky. Most buildings in Hong Kong are high-rise, thus, a lot of working at height (for example erecting scaffolding above ground level) is needed in building construction work. This leads to the riskier working environment in building construction work.

However, this company does not specifically design different safety management system, nor implement the system differently, to suit the different working environment in building and civil construction sites. The design of the safety management system will only be subject to the requirements of clients. This responds to the findings of questionnaires. In the two rankings generated from the replied questionnaires, it was found that more than half of the factors have similar or same positions on the rankings of the both works types. For the remaining factors which have diverse ranks are mainly affected by the nature of employment of workers rather than the safety management system.

Interviewee's View Towards the Safety Management System

Even though self-regulation is aimed to be achieved by implementing safety management system, Mr. Li did not agree much to its effectiveness. To him,

implementing safety management system is just to comply with the law. Workers' knowledge on safety is adequate by providing safety training and implementing safety policy on sites, however, being aware of site safety does not imply workers will perform accordingly to avoid being the victims in construction accidents. As many of them are not direct labour and they are paid on daily-basis, they tend to take risk in order to work for another project. Therefore, in general the safety management system in his company could not bring the safety to a self-regulate approach.

Besides, Mr. Li thinks that there is no relationship between safety management system and accident prevention. Safety management system includes investigation to the causes of accidents. After finding out the accident causes, something will be done accordingly to every sites and the whole company to prevent the same thing from happening again. At that period of time, workers' awareness to accident will be higher. This explains the results of improvement in workers' awareness towards site safety in the questionnaires. However, such cautiousness will not last long and workers will behave as if nothing had happened. This is mainly due to the risk-taking behaviour of workers. According to the interviewee, even though accidents are usually due to human fault, for example not using the safety belt when working at height, human-causes accidents are usually not mentioned in the reports. The responsibility will rest on the contractors and they will be blamed for not providing enough training and monitoring.

As Hong Kong labour law protects workers, therefore, even though main contractors realize that many of the construction accidents are due to human fault, they could do nothing to the workers, not even punishment or penalty. Contractors could fire the workers found fault. However, it is not always practical as skilled workers are not easy to find.

Therefore, even though accident investigations could find out the root of the problem, accidents could not be effectively prevented unless workers' attitude towards safety changed and be more aware of construction safety by utilizing the knowledge they acquired from safety training and daily experiences.

Interviewee's View Towards Improvement in Company's Image by Safety Management System

It was found from the questionnaires results that company's image and its competitiveness rank at very top positions. Mr. Li agreed with the ranking that safety management system of their company could help in establishing a better company's image. The safety management system of Mr. Li's company was certified with OHSAS 18001. OHSAS 18001 demonstrates the company's commitment to provide a safe working environment and protect their employees. Even though OHSAS 18001 is not required under law, it is a kind of recognition to the success of the safety management system of the company. This could directly enhance the company's image. Besides, such recognition could increase the company's competitiveness in bidding for construction projects. This is especially true in bidding for Housing Authority's projects as the company would be given higher score if its safety performance is being recognized.

Interviewee's View Towards Reduction in Accident Costs by Safety Management System

Mr. Li agreed that accident costs, no matter it is direct or indirect costs, did not change significantly upon the implementation of safety management system. For direct costs, it is because most of the accident costs were covered by insurance. The reduction in indirect costs, like the loss of workers' productivity after experiencing accidents, is not significant as well. It is because workers in Hong Kong flow very quickly. Even if the workers get injured, other workers can be employed to substitute.

Concerning the insurance premium, Mr. Li said it has increased a bit in recent years even if the accident rates show a decreasing trend in town. Such increase is actually due to many reasons, like the condition of plant and equipment and the nature of projects. Deteriorated plant and equipment and more complicated job nature would

result in higher insurance premium. These are not something which can be improved or changed by implementing safety management system.

Interviewee's View Towards the Successfulness of Safety Management System Under Factories and Industrial Undertakings (Safety Management) Regulation

When asked about the successfulness of their safety management system after the enactment of the Safety Management Regulation, Mr. Li's stance was neutral. To him, their safety management system does help in promoting safety. Safety committee, safety training and accident investigation are elements required under the law, which have a positive effect on increasing employees' knowledge and understanding on construction safety. However, safety management system cannot improvement much in accident prevention. This is because the root of the problem lay on the workers' minds. Even if workers' have already acquired adequate knowledge on site safety, they do not apply their knowledge accordingly to avoid accidents, which cannot be improved by safety management system.

Conclusion of Interview 1

Even though the industry's accident rate has dropped a lot over the years, to Mr. Li, the root of the problem of construction accidents in Hong Kong, which is the mindset of the workers, has not yet been solved. To completely cure the problem and improve the current situation, more time and patience are needed to educate and impress workers on the importance of construction safety. During this transitional period, the industry and the government have an important role to play in monitoring safety on sites.

Other than this major problem, safety management system does show its significance in improving the avoidable accidents and injuries. This can be supported by the drastic drop in industrial accidents of the construction industry in recent years.

Analysis of Interview 2

Background Information of the Safety Management System of the Company Before and After the legislation

The interviewee's, Mr. Chan, company has established the safety management system for about five years, which means the company set up its own safety management system shortly before the safety management system became mandatory in 2002. However, before that, the safety management system was not fully implemented on all of its construction sites. Only public projects required the provision of such system, therefore, the company's safety management system was only applied on Housing Authority and Architectural Services Department's projects but not on private clients' projects. Similar to the findings from the first interview, safety management system was first implemented in government's projects before the enactment of legislation. Thus, the government could be regarded as a pioneer in promoting such system.

The safety management system of Mr. Chan's company becomes more comprehensive by processing more elements, providing safety audit and safety review as required by the law. Now, there are ten elements in their safety management system. Mr. Chan said it sticks much closer to the law.

Mr. Chan pointed out that, nowadays, the requirement of providing safety management system between the government and private clients is generally the same. The only difference is that, public clients, like Housing Authority and Architectural Services Department, will send their staff to the sites to ensure close supervision on the safety performance. However, such extra layer of supervision done by public clients does not impose any burden to contractor actually.

Comparison Between Building and Civil Works

According to Mr. Chan, the company he is working for mainly works on building projects. They will take part in smaller scale civil projects. However, before joining this company, Mr. Chan participated in large scale civil works. To him, the accident

rates and nature of works in these two types of construction works have no big difference. If building works are said to be more vulnerable to falling from high level, the chance of such accidents happening on civil works sites is similar. It is because in law, a worker working on a level more than 2 meters above ground is also regarded as working at height. Such working environment is also common in civil construction works. This can explain why "Reduction in accidents which led to injury" and 'Reduction in minor accidents which did not lead to injury" have similar ranks on the rankings of both work types. As the difference between building works and civil works is small, the company does not design different safety management system to suit the two types of works.

Interviewee's View Towards the Safety Management System

Mr. Chan admitted that the first priority of setting up safety management system is to satisfy the law. It is because the legislation is something one must obey to. However, complying with the legislation is not the ultimate objective of the company. On the other hand, Factories and Industrial Undertaking (Safety Management) Regulation serves as a skeleton for the company to set up a comprehensive and systematic safety management system. Requirement of a safety management system was stated in the law, this directed the company to what to do. Moreover, many companies, including the one Mr. Chan works for, do more than the law required. This fact shows that setting up safety management system is not just to satisfy the law.

When asked about whether self-regulation could be brought about after the establishment of safety management system, Mr. Chan said he would be glad if self-regulation could be achieved. There are many safety team meetings on sites, hoping to convey the message of safety to the frontline members, including the foremen. However, it is a very hard task for making workers to take the initiative to be safe on sites. Thus, being the managerial staff, Mr. Chan has taken a few more steps forwards to set up a role model and implant the concept of site safety on workers' minds, though it is arduous. Mr. Chan recalled his experience of influencing a worker. On a prize-awarding ceremony, a worker was awarded to recognize his safety performance. This

worker thanked Mr. Chan for his ceaseless reminder and advice on his safety performance. From this experience, Mr. Chan reaffirmed the role of top management staff on site safety. However, it is quite disappointing that "Better communication about safety on job visits by top managers" ranks only eleventh on both rankings.

Though self-regulation could not be achieved, workers' attitude towards safety precaution has changed due to safety management system. In the past, workers were not cooperative to take safety precaution. This was especially true when there were not many legislations governing construction safety. Without legislation, main contractors have nothing to support their requirement on workers to take safety precaution. Now, with various legislations on construction safety, especially Safety Management Regulation, main contractors have sound basis to impose safety requirement on workers. Besides, having legislation as the support, workers now are more willing to take safety precaution upon requirement. This is coherent with the fourth on both rankings "Improvement in workers' awareness towards site safety".

Interviewee's View Towards Improvement in Company's Image by Safety Management System

According to Mr. Chan, company's image is very important to any construction companies. It is because good company's image is crucial for the company to remain competitive in tendering for construction projects. If there are any serious accidents or injuries happened in the sites of the company, this company would be badly labeled by clients, especially public clients. This does not only weaken the company's competitiveness in getting the projects, but also shake workers' morale.

Under the safety management system, there are a lot of promotions on site safety within the company. Besides, the company takes part in many safety competitions organized by various parties, for example the Occupational Safety and Health Council and Hong Kong Construction Association. Such functions not only can enhance the company's image, but also serves as a chance for different companies to benchmark and share their experience on promoting safety.

Interviewee's View Towards Reduction in Accident Costs by Safety Management System

To Mr. Chan's company, to reduce accident costs is not put at a high priority. This may also be one of the reasons for the low ranking of reduction in accident costs. Although the company does not place much emphasis on reducing accident costs, it has special arrangement to avoid employees' claims. According to Mr. Chan, his company arranges injured workers to take part in Rehabilitation Scheme organized by rehabilitation consultant. This scheme is only arranged for workers who need long break after getting injured or suffering from serious injuries. Investing such money on injured workers is worthwhile to the company because nowadays, workers are more aware of their right to claim for compensation. Mr. Chan pointed out that if the workers are ignored without any proper treatment, they may not only claim for compensation through Employees Compensation Ordinance, but also sue the company under common law. Facing such legal proceeding, the company will suffering from a notorious image and monetary loss. However, serious accidents do not frequently happen. Thus, in general, safety management system could not effectively reduce accident costs in Mr. Chan's company. However, the intangible benefits it brings are not measurable.

Mr. Chan did not agree with Mr. Li that insurance premium is determined upon the nature or complexity of each project as it is not practical to investigate into each project to set the premium for individual project. On the other hand, Mr. Chan said insurance premium will be determined based on the company's past performance on safety and the accident rate of the whole industry. However, it should be noted that, even if the accident rate is not low, premium must not be high if most of them are minor accidents. Besides, increased workers' awareness to claim for compensation is another factor to be taken into account.

Interviewee's View Towards the Successfulness of Safety Management System Under Factories and Industrial Undertakings (Safety Management) Regulation

From the interview, Mr. Chan showed his satisfaction towards the safety management system of his company. The company maintains the level of number of industrial accidents per 1000 workers between 15 and 20. By looking at the statistics, the successfulness of the safety management system is neutral because he aims at zero accident on site. But, generally speaking, Mr. Chan is very satisfied with the safety management system of his company. To him, the most important element to make a successful safety management system is the commitment from top management staff. Some companies perform not very well in safety because their top management staff are not willing to allocate resources on this aspect as they do not realize the importance of their commitment and support in promoting construction safety. For the company Mr. Chan working for, the top management staff realize their roles to play in construction safety. They understand that the root of construction accidents is workers' risk-taking mindset. This is cannot be changed simply by implementing a system or by enforcement of legislation. Besides, the company has a clear structure of conveying the message of safety from the top management level to the operational level. The message of site safety is conveyed from top management staff to safety manager, from safety manager to safety officers and finally reaches the very frontline employees, like the foremen. So that foremen can monitor and supervise the workers accordingly. Without such a clear structure and the top management staff's commitment, the safety management system would not be a successful one.

Conclusion of Interview 2

In this interview, Mr. Chan pointed out very clearly that the importance of top management staff's commitment in reducing accidents in the company. However, when looking back at the ranking, better communication about safety on job visits by top managers does not have very high ranks, which is worthy of concern.

Besides, Mr. Chan also blamed the subcontracting system in Hong Kong for being an obstacle in leading to safety. In Hong Kong, clients can appoint nominated subcontractors to work on site even if the two parties do not have contractual relationship. Being appointed by clients, Mr. Chan said that, nominated subcontractors are less cooperative in carrying out safety precaution and complying with safety measures. Being the main contractor, Mr. Chan does not have much control over such subcontractors. Moreover, Mr. Chan thinks that, under such subcontracting system, one of the fourteen elements of safety management system is "Evaluation, selection and control of subcontractors to ensure that subcontractors are fully aware of their safety obligations and are in fact meeting them" could not actually be achieved as main contractors have no choice for nominated subcontracts.

Analysis of Interview 3

Background Information of the Safety Management System of the Company Before and After the legislation

Hip Hing Construction Company Limited established its own safety management system seven to eight years before it was required under law. Therefore, its safety management system has no big changes before and after the legislation and thus its establishment was not to satisfy the law, but to fulfill contract requirement at that time.

Long before the enactment of Factories and Industrial Undertakings (Safety Management) System, the Works Bureau already required contractors to provide safety management system in the contract. Therefore, in order to bid for public projects, Mr. Kwan set up safety management system to comply with the contract requirement. The government acted as the pioneer to introduce safety management system to the industry and to test for its successfulness in bringing down accident rates. According to Mr. Kwan, it was found that, before the enactment of legislation, government sites really did better than private sites, where no safety management system was implemented. Thus the legislation came afterwards. Since the company's safety management system was based on the government's specification, it was modified a bit but did not change much after the legislation.

Now, safety management system is required in all construction sites of more than 50 workers, government sites still perform better. It is because main contractors not only need to follow its own safety management system, but also have to comply with the government's safety requirement. Same as what the second interviewee said, public clients, like the Housing Authority, will send safety staff on site to monitor safety performance. But it is main contractors' sole duty to monitor safety on sites. Having double layer of safety monitoring, government sites perform better in term of safety.

Comparison Between Building and Civil Works

Concerning the nature of accidents between the two types of construction work, Mr. Kwan from Hip Hing Construction Company Limited has similar view with the first interviewee Mr. Li. According to Mr. Kwan, there is a large difference in accident types between building works and civil works. Building works involve more works at high level and they work are more individual in nature. Therefore, most of the accidents happened on building construction sites involved falling from high level. For civil works, more plant and equipment are involved and thus, most of the accidents involved are related to plant and equipment, for example, being hit by moving plant.

Mr. Kwan said that safety management system of his company is useful in both types of projects. Even the nature of works is not quite the same, the safety management system will not change to suit them because such system is something about management, planning, monitoring and following policies. However, Mr. Kwan explained the difference of difficulty in implementing safety management system between the two types of works. Since there are more subcontract-works in building construction projects, workers in such sites tend to be more difficult to control and manage. On the other hand, more direct labour are employed to work in civil works projects, therefore, safety management system is easier to implement as workers are more willing to accept the management.

Interviewee's View Towards the Safety Management System

Safety management system aimed at building up a self-regulate culture in the industry. To Mr. Kwan, this is only partly achieved. In the past, when there was not safety management system, contractors had no standard to following in promoting site safety. Safety management system stated a list of elements to be provided by main contractors and also how the responsibilities are to be executed. Thus, safety management system can help educate staff and workers and let them realize it is their duty to keep themselves away from dangers. However, workers do not actively comply with the requirement even they have the knowledge and they will not do more than contractor required. Therefore, Mr. Kwan said self-regulation is only partly achieved by implementing safety management system. However, the greatest improvement brought by safety management system is that, workers today are less reluctant to take safety precaution. This is an important step towards self-regulation. This also explains the fourth and fifth ranks on rankings, workers' awareness and behaviour are improved.

Interviewee's View Towards Improvement in Company's Image by Safety Management System

Image is very important to construction company including Hip Hing Construction Company Limited. Top management staff put very much emphasis on building up a good company's image. Therefore, they will allocate resources in enhancing company's safe image. Company's image is important because it plays a rather essential role in the tendering process. Clients, especially public clients, are more aware of the safety promotion and safety award received by the contractors. Thus, becoming safer could enhance the company's image and also its competitiveness in bidding for projects.

Interviewee's View Towards Reduction in Accident Costs by Safety Management System

Concerning the insignificance in reducing insurance premium, Mr. Kwan holds similar view to Mr. Chan in the second interview. Mr. Kwan agrees that insurance companies look at past safety performance of the contractors and the whole industry to determine premium. But the effect of accident rate on premium is less significant nowadays because workers' awareness on civil claim is stronger than before. As premium is partly depends on amount and number of claims, premium becomes higher now. This is why the effect of safety management system on reducing insurance premium is small.

Interviewee's View Towards the Successfulness of Safety Management System Under Factories and Industrial Undertakings (Safety Management) Regulation

Mr. Kwan is satisfied with successfulness of the safety management system of his company. He quoted the accident statistics of the company to support. In 1995, when there was no safety management system in his company, the number of industrial accidents per 1000 workers was more than 120, which is very alarming. Now, after ten years of evolution and the backup of legislation, safety management system becomes more sophisticated. Now, there are less than 15 accidents per 1000 workers.

Such a drastic drop in accident rates in mainly due to the improvement in safety management brought about by the system. This explains why the three objectives in setting up safety management system as stated by the Labour Department get rather high ranks on both building works and civil works. However, Mr. Kwan thinks that safety management system could not change workers' risk-taking mind. This is the why the accident rate becomes stagnant in recent years. But generally speaking, workers' attitude and behaviour have improved a lot after the implementation of safety management system due to the increase education and promotion of site safety.

Conclusion of Interview 3

Hip Hing Construction Company Limited has done very well in safety and it is recognized by the many awards it got over the years. Improvement in safety performance is not by chance but caused by the effort and commitment of staff from different levels. Among them, top management staff's support is especially important. It is because they are those who can approve or ban any proposals. They recognize the importance of safety to a company and thus become willing to commit to it by allocating resources, taking part in different competitions and so on. Once again, it shows the importance of top level management staff's commitment.

General Summary of Interviews Findings

From the three interviews, two points could be concluded concerning the safety management system. Firstly, safety management system provides a systematic framework for the industry to follow. This greatly enhances the management of site safety as safety professionals have a clearer direction. The elements included in safety management system could also improve workers' knowledge thus their awareness and behaviour about site safety. They become more aware of protecting themselves from accidents as the responsibilities of being safe are clearer under safety management system.

However, the system could not radically cure the cause of construction accidents in Hong Kong, which is the mindset of workers. Though they have enough knowledge and have shown improvement in their awareness and behaviour, they are not used to self-regulate. Therefore, accident-free construction site has still a long way to go. Moreover, the interviewees acknowledged the importance of top management staff's commitment. This is essential in reforming workers' mindset. Therefore, safety performance could not further improve until top management staff of construction companies realize their role to play in bringing about an accident-free industry.

Summary

The effectiveness of safety management system under the Factories and Industrial (Safety Management) Regulation could be viewed from two perspectives. It could first be observed from the subjective opinions of the safety professionals from the last two questions in the questionnaires and their degree of satisfactory from the interview. Secondly, the effectiveness of safety management system could be found out from the rankings of the three objectives.

In the first way of looking at the effectiveness, more than 60% of the respondents agreed that Safety Management Regulation could effectively lead to safer construction sites. 11% of them even strongly agreed with the effectiveness of the system. For the effectiveness of safety management system in building up safety culture in the company, more than 60% of the respondents agreed in it and 4% of them strongly agreed. But it should be noted that more than 30% of the respondents only slightly agreed that the Safety management Regulation could help build up safety culture in the company.

Besides, from the three structured interviews, it is found that interviewers are generally satisfied with the safety management system of their companies. Though the interviewees think that such system could not improve very much the workers' risk-taking mindsets, at least they become more aware of safety on sites. Accident investigation also helps in finding out the underlying causes of accidents. This is one of the reasons to improve workers' awareness. Therefore, it could be concluded that, the safety management system and also the Safety Management Regulation are effective in leading to safer construction sites and building up safety culture in the company. However, the effectiveness in leading to safer sites is more significant than in building up safety culture in the company.

To look at the rankings of objectives in building and civil construction works, the three objectives occupy a relatively high position on ranks. That is to say, safety management system is quite effective in achieving its designated objectives. However,

it is even more effective in bringing about other factors – Improvement in Company's Performance. In short, the safety management system and the Factories and Industrial (Safety Management) Regulation cannot be said to be very but effective.

Chapter 7 Conclusion and Recommendation

Summary of Study

Hong Kong is well-known for its skyscrapers construction but also for its poor construction safety performance among other developed cities. In regard of the poor performance, the government has tried to use enforcement approach in dealing with safety problems on construction sites. However, statistics showed this approach could not achieve the designated objective in bring down accident rate. Viewing better performance in public construction sites by requiring main contractors to provide safety management system, the government introduced such system, hoping to shift the enforcement approach to a self-regulating one. As a result, the Factories and Industrial Undertakings (Safety Management) Regulation took effect in April 2002 and all construction sites having more than 50 workers or contract value of $100 million or more are required to implement safety management system and carry out safety audits of their system. Other than fulfilling the legislation, contractors also hope to grasp the benefits brought the safety management system. The legislation has already taken effect for about four years, it is time to evaluate the effectiveness of safety management system under the law, that is to find out whether the legislation could bring about a safer construction industry.

Due to the difference in nature of works and types of accidents in building and civil construction works, the effectiveness of safety management system on the two types of works was also the focus of study.

The cost for setting up safety management system is diversified among the responding companies. They ranged from HK$50,000 to HK$500,000. This amount tends to be proportional to the scale and popularity of the company. It shows that the average safety investment on establishing safety management system by smaller companies is not enough. Moreover, from the duration of establishment of safety management system, it is found that some companies' systems are quite new. Thus these systems

may not be sophisticated and systematic enough to bring about safer sites at the moment.

Spearman's rank correlation coefficient was calculated to find out whether the two rankings agree with each another. The coefficient was found to be +0.972, which is larger than the critical value. Therefore it can be implied that the two rankings obtained from building projects and civil projects agree with each another. The reason behind is that, every construction firm only adopt one safety management system usually and the system is applied on both building and civil projects of the company.

Some obvious similarities and differences in the ranking of the same factors were observed from the questionnaire results. It showed that safety management system is most effective in improving company's performance in both civil and building construction projects. This includes enhancing company's image by getting awards in safety competitions held by various organizations like the Labour Department and Hong Kong Construction Association and improvement in company's competitiveness in tendering for construction projects. For the three objectives of setting up safety management system as stated by the Labour Department, they are achieved satisfactorily. Improvement in accident-reporting process, which represents the objective "ensure accidents are reported and handled properly", is the third on building works rank and the fifth on civil works rank. Improvement in workers' behaviour that may lead to accidents, which represents the objective "prevent improper behaviour that may lead to accidents", is the fifth on both works ranks. More hazards or problems which may lead to accidents are detected and reported, which represents the objective "ensure problems are detected and reported". Though the objectives do not occupy the topmost position, their rankings are relatively high. Therefore, it could be concluded that safety management system can achieve its designated objectives quite well. Being able to achieve the objectives, the effectiveness of safety management system is recognized. Besides, from the questionnaires, more than 70% of the respondents agreed that Factories and Industrial Undertakings (Safety Management) Regulation, and also the safety management system, could effectively bring about safer building

and civil works sites. These also recognized the effectiveness of safety management system.

In improving workers' awareness towards site safety and workers' behaviour that may lead to accidents, safety management system did quite well. These two items either rank the fourth or the fifth in both types of works. It is understandable because safety management system involves accident investigation to find out the causes of accidents, which can draw workers' attention to the matter of safety and also to take appropriate actions in avoiding becoming the victims.

However, safety management system is not effective in reducing accident costs. From the two rankings generated from the questionnaire results, the bottom-most positions are occupied by items of "Reduction in Accident Costs". These include reduction in employees compensation, reduction in damages to equipment and tools, reduction in indirect cots and reduction insurance premium. Such ineffectiveness may be resulted from the increased awareness to claim for compensation which directly affects the amount of insurance premium.

The items abovementioned have similar ranks in building works and civil works, there are some items which are affected by the safety management system differently. These items include:

- more control over subcontractors
- closer supervision of workers
- increase in workers' morale

Such differences are mainly due to the portion of subcontracting works in the two types of works. In building works, there are more subcontracting works and in civil works, more workers are directly employed by main contractors. As there are more direct labour in civil construction work, main contractors have more control over subcontractors and have closer supervision of works. Moreover, direct labour have

stronger sense of belonging to the main contractors. Therefore increase in workers' morale is more significant in civil construction projects.

In the second phase of study, three structured interviews were conducted with safety managers of three construction companies in Hong Kong. It is found from the interviews that safety management system was initiated by the government to implement in public construction sites. Since the safety management system was implemented, safety performance on site improved. Therefore the government made the provision of such a system mandatory under Factories and Industrial Undertakings (Safety Management) Regulation, hoping to shift the enforcement approach to a self-regulate one.

In Hong Kong, the age of safety management system differs from company to company. For large companies, their safety management systems have been established for quite a long time. While for the smaller companies, their systems have set up for a few year only (just after the legislation) are less sophisticated. In the interviews, the ages of safety management system ranged from five years to more than ten years. These companies all had something similar in safety management system before the legislation came into effect and such systems were only required by public clients, for instance Housing Authority. Since the systems are provided according to the requirement of the government, thus they do not vary very much from the one required under law. As a result, the safety management systems of the three companies do not vary much before and after the legislation came into effect.

However, all the three interviewees think that there is still a chasm to self-regulation in the industry. The main reason for this gap is the mindset of construction workers. Many of the construction workers are subcontractors' workers who are not directly employed by main contractors, they are paid on daily basis, and thus they have very little sense of belonging to the main contractors. The implication of the lack in sense of belonging is the neglect of safety rules or measures on sites. Since workers have no bearing on site safety, they tend to ignore such time-consuming precaution so that they can finish the tasks more quickly and work on other sites again. Such situation has

actually improved over the years according to the interviewees, workers' risk-taking minds have not been totally cured yet. This is the root problem of construction safety in Hong Kong and is also being blamed for the stagnant accident rates in recent years.

Another finding from the interviews is the impact of top management staff's support on safety performance of a company. From the interviewees' experience, top management's support is essential in bring about a safer culture among the workers. Financial support from top managerial level is undoubtedly important, because if the staff are not willing to spend money on safety (that is safety investment), safe site could hardly take place. Besides financial support, top management staff have to realize their roles to play in safety. They should appreciate the communication between them and the frontline workers, which could impress the workers and thus improve the workers' risk-taking mindset.

The Factories and Industrial Undertakings (Safety Management) Regulation, as described by the interviewees, serves as a backbone for contractors to implement different safety measures and require workers to comply with different safety requirements. With this regulation, main contractors have stronger bargaining power to request workers to perform safety precaution. Having safety management system, safety professionals have a more systematic framework to follow.

All in all, safety management system under Factories and Industrial Undertakings (Safety Management) Regulation can be regarded as effective not only because the three designated objectives occupy high positions on the two rankings for building and civil construction projects, but it can also bring along intangible benefits to the construction companies, for instance the improved companies' images. Moreover, the regulation of making safety management system mandatory provides practitioner a more systematic framework to implement safety measures. However, the industry should not be satisfied in this stage as the root cause of construction accidents, which is the risk-taking mindsets of workers, has not yet been solved.

Recommendation

Government tried to change its strategy on construction safety from focusing on enforcement to promoting safety management. The enactment of Factories and Industrial Undertakings (Safety Management) System hopes to bring self-regulation to the industry, which is believed to be the long-term solution to construction accidents in Hong Kong. However, though workers' attitudes have changed over the years, the risk-taking mind seems to have rooted and this is one of the major reasons hampering the construction accidents from going down any further.

Workers' mindset could not be changed in a blink of an eye. It is a long term process which needs the support from the government and top management staff very much. The government has actually realized the failure of enforcement approach in bringing about safety in construction industry, thus Factories and Industrial Undertakings (Safety Management) Regulation emerged. However, workers' mindset has to be changed before the industry can become totally self-regulated. During this transitional period, the government should take a more active role in implanting the concept and attitude of being safe on sites. For example, more promotional items, like advertisement and posters, indicating the disastrous outcome to the victims and their families. It is because family is the most important element to most Chinese. Moreover, managerial staff should realize their roles in changing workers' mindset towards site safety. It was proved by one of the interviewees that management staff can really impress workers and lead them to take active role in site safety. Even the chance of impressing a worker is not high, once a worker is impressed, his behaviour and mindset can spread from mouth to mouth and the worker can be an influential source in impressing and persuading other workers. Therefore the government and the top management staff of construction companies should take a more active step to work for an accident-free construction industry.

Limitation of Study

The major limitation of this research is the limited sample size. Altogether 120 questionnaires were sent but only 28 replies, resulting in 23.3% response rate. The responding rate for civil works questionnaires is even lower with only 8 replies. Besides, among the 28 questionnaire replies, only 3 respondents were willing to leave their contact numbers for a detailed interview. Therefore, the results of the study may not be very conclusive and representative. The comments on the effectiveness of safety management system and its impacts on buildings and civil construction works given by the 3 interviewees may not be conclusive and representative enough too.

The aim of this dissertation is to find out the effectiveness of safety management system after the Factories and Industrial Undertakings (Safety Management) Regulation came into effect in April 2002. Nineteen factors were ranked by using the effectiveness index to find out how high are the three objectives stated by the Labour Department are. However, nineteen factors seem too be too many and thus only those elements on the topmost and bottom-most positions, which the safety management system have stronger impacts on, are discussed in more detail and to greater depth. Those on the middle part are not discussed in detail in the interview because of the limited time offered by the interviewees.

In short, the study could be improved by using a greater sample size of interviewees so that the questionnaires results could be more reliable and representative. Besides, the chance of having more respondents to be interviewed is greater, so that all the nineteen factors could be commented on by the increased number of interviewees even they can only offer limited time for interview.

Suggestions for Future Study

This research aims at finding out the effectiveness of safety management system after the enactment of Factories and Industrial Undertakings (Safety Management) Regulation and to compare its effectiveness in building construction works and civil

construction works. There are nineteen factors to be ranked under this study, which is quite general. Further study can focus on some of the nineteen factors so that more in-depth research can be conducted. For example, study on the effectiveness of safety management system in reducing accident costs is obviously low in this study. Therefore factors under this category could be drawn out to be studied in more detail. Say, the ineffectiveness could be proved by calculating the actual accident costs and safety investment.

Besides, two points raised by the interviewee worth further study, which is the relationship between nominated subcontractors and safety performance and the risk-taking behaviour of construction workers even they possess adequate safety knowledge.

However, researchers in the future should try to increase the response rate so that the findings of the research could be more representative and reliable. This could be done by going to the target companies in person and fill in the questionnaires together with the respondents. This could not only increase the response rate of the questionnaires, but also that of interview. It is because the contact number of the respondents so that interviews could be conducted with them after the questionnaire results are analyzed.

Appendix I

Sample of Building Works Questionnaires

Effectiveness of the Factories & Industrial Undertakings (Safety Management) Regulations Questionnaire
Building Works

Below is a set of question divided into 2 parts. Please fill in the information and tick the appropriate answers as instructed.

Part I General Information

Name of your Company _____

Your position in the Company _____

Duration of the establishment of a safety management system _____ years

The cost of setting up the system HK$ _____

Part II Effectiveness of Safety Management System

Below are some benefits of implementing a Safety Management System. Please tick how effective the system is in bringing about the benefits regarding to the ***building*** works carried out by your company after the Factories and Industrial Undertakings (Safety Management) Regulation came into effect in April 2002.

	Very Effective	Effective	Slightly Effective	Not Effective
<u>Improvement in Workers' Performance</u>				
Increase in workers' morale	☐	☐	☐	☐
Improvement in workers' awareness towards site safety	☐	☐	☐	☐
Improvement in workers' behaviour that may lead to accidents	☐	☐	☐	☐
<u>Reduction in Accident Costs</u>				
Reduction in employees compensation	☐	☐	☐	☐
Reduction in damages to equipment and tools	☐	☐	☐	☐
Reduction in insurance premium	☐	☐	☐	☐
Reduction in indirect costs, such as cost of time lost by foremen, supervisors or other executives in helping or investigating accidents	☐	☐	☐	☐
<u>Improvement in Project Performance</u>				
More hazards or problems which may lead to accidents are detected and reported	☐	☐	☐	☐
Reduction in minor accidents which did not lead to injury	☐	☐	☐	☐
Reduction in accidents which led to injury	☐	☐	☐	☐
Reduction in day losses due to accidents	☐	☐	☐	☐
Reduction in project duration due to fewer accidents	☐	☐	☐	☐
Improvement in accident-reporting process	☐	☐	☐	☐
<u>Improvement in Company's Performance</u>				
Improvement in company's image, e.g. winning in safety competitions	☐	☐	☐	☐
Improvement in company's competitiveness in bidding	☐	☐	☐	☐

Improvement in Project Management				
More control over subcontractors (in term of site safety)	☐	☐	☐	☐
Better House-keeping	☐	☐	☐	☐
Closer supervision of the workers	☐	☐	☐	☐
Better communication about safety on job visits by top managers	☐	☐	☐	☐

	Strongly Agree	Agree	Slightly Agree	Not Agree
In general, Factories & Industrial Undertakings (Safety Management) Regulation is effective in leading to safer ***building***-work sites of your company.	☐	☐	☐	☐
In general, Factories & Industrial Undertakings (Safety Management) Regulation is effective in building up a safety culture in your company.	☐	☐	☐	☐

Should you have any queries, please contact Rachel Li at 95253616 or email to h0322050@hkusua.hku.hk.

Thank you very much for your help. May you grant me an interview and give me your name and contact number?

☐ Yes Name: _____ Contact Number: _____

☐ No

To return the questionnaire (best before 17th February, 2006) please use the enclosed envelop.

Appendix II

Sample of Civil Works Questionnaires

Effectiveness of the Factories & Industrial Undertakings (Safety Management) Regulations Questionnaire
Civil Works

Below is a set of question divided into 2 parts. Please fill in the information and tick the appropriate answers as instructed.

Part I General Information

Name of your Company _____

Your position in the Company _____

Duration of the establishment of a safety management system _____ years

The cost of setting up the system HK$ _____

Part II Effectiveness of Safety Management System

Below are some benefits of implementing a Safety Management System. Please tick how effective the system is in bringing about the benefits regarding to the ***civil*** works carried out by your company after the Factories and Industrial Undertakings (Safety Management) Regulation came into effect in April 2002.

	Very Effective	Effective	Slightly Effective	Not Effective
<u>Improvement in Workers' Performance</u>				
Increase in workers' morale	☐	☐	☐	☐
Improvement in workers' awareness towards site safety	☐	☐	☐	☐
Improvement in workers' behaviour that may lead to accidents	☐	☐	☐	☐
<u>Reduction in Accident Costs</u>				
Reduction in employees compensation	☐	☐	☐	☐
Reduction in damages to equipment and tools	☐	☐	☐	☐
Reduction in insurance premium	☐	☐	☐	☐
Reduction in indirect costs, such as cost of time lost by foremen, supervisors or other executives in helping or investigating accidents	☐	☐	☐	☐
<u>Improvement in Project Performance</u>				
More hazards or problems which may lead to accidents are detected and reported	☐	☐	☐	☐
Reduction in minor accidents which did not lead to injury	☐	☐	☐	☐
Reduction in accidents which led to injury	☐	☐	☐	☐
Reduction in day losses due to accidents	☐	☐	☐	☐
Reduction in project duration due to fewer accidents	☐	☐	☐	☐
Improvement in accident-reporting process	☐	☐	☐	☐
<u>Improvement in Company's Performance</u>				
Improvement in company's image, e.g. winning in safety competitions	☐	☐	☐	☐
Improvement in company's competitiveness in bidding	☐	☐	☐	☐

Improvement in Project Management				
More control over subcontractors (in term of site safety)	☐	☐	☐	☐
Better House-keeping	☐	☐	☐	☐
Closer supervision of the workers	☐	☐	☐	☐
Better communication about safety on job visits by top managers	☐	☐	☐	☐

	Strongly Agree	Agree	Slightly Agree	Not Agree
In general, Factories & Industrial Undertakings (Safety Management) Regulation is effective in leading to safer ***civil***-work sites of your company.	☐	☐	☐	☐
In general, Factories & Industrial Undertakings (Safety Management) Regulation is effective in building up a safety culture in your company.	☐	☐	☐	☐

Should you have any queries, please contact Rachel Li at 95253616 or email to h0322050@hkusua.hku.hk.

Thank you very much for your help. May you grant me an interview and give me your name and contact number?

☐ Yes. Name: _____ Contact Number: _____

☐ No

To return the questionnaire (best before 17th February, 2006) please use the enclosed envelop.

Appendix III

Sample of Interview Questions

Comparison Between Building & Civil Works

1. As civil construction works are more complicated in nature, do you think there are any differences in implementing SMS on building works sites and civil works sites?
2. How would you comment on the ranking of Building Works & Civil Works?

Comparison Before & After the Legislation

3. SMS became mandatory under Factories & Industrial Undertakings (Safety Management) Regulations and it took effect in April 2002. Are there any changes to the SMS of your company? Do you think the regulations could successfully help bring construction safety from enforcement to self-regulate?
4. Does the safety performance of your company improve significantly? Any statistics to support? If yes, in what aspect and by how much?

Success & Worthiness of SMS in general

5. According to the Labour Department , 3 advantages could be obtained by setting up Safety Management System, they are i) reduce the risks to the employees and other people, ii) increase the efficiency of the business operations and iii) help the organization to build a responsible image. To what extend do you think your company grasped these three advantages?
6. What are the factors that make your SMS successful/ fail? Why are these factors so influential?
7. From the questionnaire results, it was found that items under "Reduction in Accidents Costs" rank quite low. So, does your company experience the same situation? If yes, do you think the setting up a SMS has low value (taking into the accident costs & setting up, running and operation costs) and the system is set up just to satisfy the law? If no, how the SMS of your company save accident costs?

Appendix IV

Sample of Invitation Letter for Questionnaire

19th January, 2006

Dear Sir/ Madam,

Re: A Questionnaire on the Effectiveness of Safety Management System

I am a final year student of the University of Hong Kong major in surveying. I am now undertaking an undergraduate research dissertation about the effectiveness of Safety Management System in Hong Kong's construction industry after the Factories & Industrial Undertakings (Safety Management) Regulation came into effect in April 2002.

Attached are **two 2-page questionnaires** to find out how contractors in the territory think the effectiveness of their Safety Management System is in leading to the benefits stated. One for building works and one for civil works carried out by your company. Please fill in one or both of the questionnaires according to the nature of your company (i.e. to fill in both of the questionnaires if your company specializes on both building and civil works).

Your assistance would definitely help in the progress and the success of my dissertation. Please return the completed questionnaires by using the enclosed envelop (best before 17th February, 2006). Should you have any queries, please feel free to contact me at 95253616 or email to h0322050@hkusua.hku.hk.

I look forward to your reply. Thanks for your help.

Yours faithfully,
Rachel Li

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