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THE UNIVERSITY OF HONG KONG

A STUDY OF CAUSES OF CONSTRUCTION ACCIDENTS IN REPAIR, MAINTENANCE, MINOR ALTERATION AND ADDITION (RMAA) WORKS IN HONG KONG

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

DEPARTMENT OF REAL ESTATE AND CONSTRUCTION

BY
AU CHI PING
HONG KONG
APRIL 2007
Declaration

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

Signed: ________________________________
Name: ________________________________
Date: ________________________________
Acknowledgements

I would like to express my sincere thanks to my supervisor, Dr S. W. Poon for his invaluable guidance and enlightening comments throughout my preparation this dissertation. Without his inspiration, patience and suggestion, completion of the dissertation would not have been possible.

Special thanks are dedicated to Professor Rowlinson for his guidance in data collection and Mr. T.T. Cheung for the valuable advices on my dissertation topic.

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- Mr Chan Sam Choi, Concrete Industry Workers Union, Secretary General
- Mr. Patrick W.T. Chan, The Hong Kong Construction Association, Secretary General
- MR. Wu Suk Keung, Architectural Services Department, Property Service, Contracts management & Site Safety group
- Mr. Shing Wai Lam, Johnny, Society of Registered Safety Officers, Vice-president
- Mr. Joseph HC Chong, ISG Asia (Hong Kong) Limited, Chartered Quantity Surveyor
- Mr. Norbert C Y Fan, N C Fan China Consultants Ltd., Sub committee of Society Register Safety Officers
- Mr. Edmond S C Chan, Gammon Construction Limited, Technical services manager (Health, Safety & Environment)

At last but not least, heartfelt thanks are given to my family, Surveying Society Session 2005-2006 Executive Committee Unique, SSO05 OC Fusion, all dear friends, fellow classmates and beloved Nick, for their continuous care, support and encouragement.
Abstract

Over the years, the accident rate in the construction industry has been higher than that in other industries in Hong Kong. Although the overall safety record of the construction industry in Hong Kong has slightly improved in recent years, there is an alarming increase in the number of accidents in Repair, Maintenance, Minor Alteration and Addition (“RMAA”) Works. In 2004, the number of accidents in RMAA works contributes one third of the total number of accidents in the construction industry. This paper aims to examine the characteristics of RMAA works and the causes of construction accidents in RMAA Works in Hong Kong. Corresponding recommendations are suggested at the end of the paper to tackle the safety problems in the industry.

The possible causes and cost of construction accidents, and various safety measurements are identified by extensive literature review. Interviews of various construction practitioners and questionnaires are conducted to examine the crucial factors of accidents in RMAA works in all-round aspects. The former reflected the current safety performance in the construction industry and the effectiveness of the current safety management system. The results of the latter are analyzed by a multiple regression model. By using such quantitative approach, the significance of the possible factors affecting site safety mentioned in the literature review can be identified.

RMAA works are characterized by small scale, short time duration, loose scheduling, insufficient supervision and causal employment. There is a need for a more effective monitoring in terms of health and safety. Leaving to the Labour Department alone is not the most desirable way to control accidents involving RMAA works. Both employers and employees should spend more efforts to focus on promoting positive safety attitude on RMAA works. Furthermore, the government and contractors should work closely together
and put greater efforts for the benefit of the whole construction industry, for instance, promoting a positive safety climate and providing training and education for workers.
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Part I
Prologue
Chapter 1 Introduction

1.1 Background

Construction industry contributes a great proportion in the Gross Domestic Product of Hong Kong each year. The industry keeps the third place in the contribution of Hong Kong’s Gross Domestic Product, following the service sector and manufacturing sector.(Table 1)

<table>
<thead>
<tr>
<th>Economic activity</th>
<th>2000</th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture and fishing</td>
<td>920</td>
<td>1,003</td>
<td>1,002</td>
<td>824</td>
<td>886</td>
</tr>
<tr>
<td>Mining and quarrying</td>
<td>241</td>
<td>174</td>
<td>136</td>
<td>116</td>
<td>72</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>67,646</td>
<td>59,760</td>
<td>51,396</td>
<td>44,403</td>
<td>44,455</td>
</tr>
<tr>
<td>Electricity, gas and water</td>
<td>36,917</td>
<td>37,957</td>
<td>39,609</td>
<td>38,839</td>
<td>39,726</td>
</tr>
<tr>
<td>Construction</td>
<td>62,054</td>
<td>57,167</td>
<td>51,534</td>
<td>44,910</td>
<td>40,376</td>
</tr>
<tr>
<td>Services</td>
<td>1,087,570</td>
<td>1,088,211</td>
<td>1,091,272</td>
<td>1,073,941</td>
<td>1,130,301</td>
</tr>
</tbody>
</table>

Table 1. Gross Domestic Product(GDP) by Economic Activity at Current Prices


Census and Statistics Department

When comparing the manufacturing industry, the construction industry is often classified as a high-risk industry. The injury rate is unacceptably high. According to the Labour Department there were numbers of 3,548 cases of industrial accidents within the construction industry, which is 20.9% out of 1,6917 cases for the total number of accidents in all economic sectors in 2005. In comprise with other economic sector, construction industry occupy the second highest rate of industrial accidents and
occupational injuries. In term of fatality, the fatality rate of construction accident is far higher than those in other economic sectors. There were 25 fatal cases i.e. 86.2% out of total 29 in all the economic sectors. (Table 2)

<table>
<thead>
<tr>
<th>Industrial Accident</th>
<th>No. of cases 2004</th>
<th>No. of cases 2005</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction</td>
<td>3833 (17)</td>
<td>3548 (25)</td>
</tr>
<tr>
<td>Catering</td>
<td>9410</td>
<td>8902</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>2936 (2)</td>
<td>2912</td>
</tr>
<tr>
<td>Others</td>
<td>1354 (5)</td>
<td>1555 (4)</td>
</tr>
<tr>
<td>Total</td>
<td>17533 (24)</td>
<td>16917 (29)</td>
</tr>
</tbody>
</table>

( ) No. of fatal cases

Table 2. Table of Occupational Safety and Health Statistic 2005


Labour Department

The site safety record of Hong Kong is very poor in the international standard. In 1994, there were 275 reported accidents per 1,000 workers per year. Although the government had put much effort on legal enforcement and education and promotion about construction site safety, the number of accident still remains around 150 per 1,000 workers per year in 2000. Comparing with the figure in Japan, there were only about 10 per every thousand workers suffered an injury each year. And the figure for the United Kingdom was around 50 per 1,000. In terms of fatality rate, Hong Kong was around seven times higher than that in Japan and doubles the figure in United Kingdom in 2000. Reviewing the effort of the government in this recent five years, both the number of
accident and accident rate have been falling slightly. The total number of accident dropped to 3,833 cases and the accident rate per accident decreased to 60.3 per thousand workers. Although the figures sound encouraging to the construction industry, there has been growing concern about the rising accidents rate in repair, maintenance, minor alteration and additional (RMAA) works. The number of accidents from the RMAA works occupies considerable proportion of the total reported accident of the construction industry. RMMA accidents accounted for one-third of the overall accident and fatalities in the construction industry in 2004. There was a rising trend in the past five consecutive years. (Table 3)
### Table 3. Industrial Accidents of RMAA Works

*Accidents in the Construction Industry of Hong Kong (2000-2004)*

*Labour Department*

<table>
<thead>
<tr>
<th>(a) All reported construction accidents</th>
<th>2000</th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>11925 (29)</td>
<td>9206 (28)</td>
<td>6239 (24)</td>
<td>4367 (25)</td>
<td>3833 (17)</td>
</tr>
</tbody>
</table>

| (b) Accident rate per 1000 workers     | 149.8      | 114.6      | 85.2       | 68.1       | 60.3       |

| (c) All reported accidents in RMAA     | 3402 (12)  | 2582 (4)   | 1925 (10)  | 1485 (8)   | 1454 (6)   |

| (i) No. of reported accidents in RMAA Works in public sector sites | 475 (1) | 331 (2) | 250 (2) | 158 (2) | 104 (0) |

| (ii) No. of reported accidents in RMAA Works in private sector sites | 2927 (11) | 2251 (2) | 1675 (8) | 1327 (6) | 1350 (6) |

| Percentage of RMAA accidents to all reported construction accidents | 28.5 % | 28.0 % | 30.9 % | 34.0 % | 37.9 % |

| ( ) No. of fatal cases |
1.2 Aim and Objectives

When compare with the past, the demand for big construction is decreasing in Hong Kong due to the saturation of development opportunity. Instead of big development, urban renewal becomes the hot issue in Hong Kong these days. According to the urban renewal strategy proposed by the Housing, Planning and Lands Bureau (which has been issued to the Urban Renewal Authority), the Government aims to redevelop 2,000 ageing or dilapidated buildings in the coming 20 years. Due to the alteration of the nature of Hong Kong construction market, the demand for repair, maintenance, minor alteration and additional (RMAA) works increases. RMAA works including minor alterations, repairs, maintenance and interior decoration of existing buildings and the construction of village house in the New Territories.

The construction industry has usually over looked in the past the increasing importance and significant of these small works of construction. That results in little attention for these RMAA works has received in the field of published literature. (Kwok, 2006)

This study aims to investigate the causes of construction accidents in RMAA works and the objectives of this study are as follows:

- Review the current safety performance of construction industry and RMAA
- Examine the safety practice in construction industry and RMAA
- Investigate all possible factors affect construction safety in RMAA
- Evaluation the safety climate and its impact on safety performance
- Recommendation for improvement of safety performance
1.3 Methodology

Both qualitative and quantitative approaches will be used to analyze the factors affecting the safety performance of RMAA works.

Qualitative approach was used to investigate the accident causation of RMAA work. The number of construction works, the accidents reports and safety audit reports for the past ten years will be collected to illustrate the structural change of the construction industry and the trend of the RMAA works accident rate. Accident causation theory will be discussed and applied.

Regression model was developed as a quantitative approach to analyze the influence of factors affecting safety performance of RMAA work in Hong Kong. In order to collect sufficient data for constructing a regression model, questionnaires would be constructed and delivered. The target group will be the small or medium sized contractors.

Interview with the Government bodies and semi bodies including Labour Department, Hong Kong Construction Association, Hong Kong House Authority were conducted for evaluating the effectiveness of legal enforcement and the dissemination of construction site safety message. The practice of private and public sector will be compared in order to detect the cause of different accident rate.
1.4 **Structure of Dissertation**

In section one, prologue, there is an introduction of the dissertation on its aims, objective and structure. Brief background information of the construction in Hong Kong and the situation of construction safety of RMAA works is given in this chapter as well.

In section two, literature review, the cost of accidents will be discussed. The cost can be both tangible and intangible. Liquated damages is one of the concrete examples of the cost of accidents related to the failure to meet project deadlines. Financial penalties and insurant terms are other tangible cost. The accident causation theory will also be discussed in this section.

In section three, the current situation of safety performance of the construction industry in Hong Kong will be reviewed. This section mainly focus on the unique nature and culture of the construction industry in Hong Kong, the attitude of the construction workers, the legal enforcement, management perspective and techniques, training and education provided by the government bodies and semi-government and unique sub-tropical climate of Hong Kong.

Section four is the overview of the RMAA works in Hong Kong. The changing trend of the construction industry will be revealed. The demand and development of the RMAA work market in Hong Kong will be discussed. In this section, there will be evaluation of safety performance in the RMAA work.
In section five, all factors influencing construction safety will be investigated. The focus of this section is on the difference of the factors affect the safety performance for traditional large construction project and RMAA works.

Section six, methodology, will reveal and explain the research method used in data collection, the procedure of developing the regression model and the interpretation of the findings. The rational behind the way data was analyzed is presented. Charts, tables and summary are used to illustrate the meaning of the findings.

Lastly, in section seven, epilogue, there is a summary of the whole dissertation. Recommendation would be suggested for improving the safety performance of RMAA works. Further more, limitation of this study and recommendation for further study is included in order to maximize the contribution of this study.
Part II

Literature Review
Chapter 2. Literature Review on Accidents

2.1 Definition of Accidents

Risk, danger, hazard, and accident are closely related to construction safety. However, these words have different meanings between laymen and professional. They may lead to confusion to laymen.

Lee(1991)\(^1\) explained that the definition of risk. Risk means the probable loss over a specific period of time. It focuses on the probability. It can be indicated by the probabilistic occurrence of an event or an accident combined with the consequences of that event.

In the paper of Raafat (1989)\(^2\) “Product Liability and Risk Strategy”, published in the journal of Health and Safety March 1989 UK, risk is defined as:

\[
\text{Risk} = \text{Probability of Failure} \times \text{Severity}
\]

In other word, risk is the quantitative values of the probability and the severity.

For example, the risk of an explosion of an air receiver is the probability of explosion combined with the severity of the consequence of the explosion.

\(^1\) Lee, H K, Safety Management: Hong Kong Experience, 1991, Hong Kong: Willy Printing Company
Lee (1991) also defined danger as the presence of a situation which can inflict injury or damage if an error is made. If an operator makes an error or the machine malfunctions, injury may be inflicted.

Hazard relates to occupational health stated in Lee (1991). It takes time for a disease to arise from occupation in a hazardous environment. In Britain, 90% of the 100,000 chemical substances used at work are not tested for toxicity. Control of Substances Hazardous to Health Regulation (COSHH Regulation) enacted in 1988 in order to improve the awareness of health hazards from chemicals.

According to the Shorter Oxford English Dictionary (1995) the word accident was first recorded in the Middle English period. The Oxford Dictionary of English Etymology (1966) notes that the word accident was first recorded in the fourteenth century, in the writing of Chaucer, meaning ‘something that happens’

Most dictionary definitions imply an element of change, for example ‘an event in condition occurring by chance or raising from unknown or remote cause’ –webster (1954)
Chapter 2 Literature Review on Accidents

Hinze (1997) defined accident as an unplanned, undesirable and non-controlled event\(^3\).

An accident does not necessarily result in an injury, it can also result in damage to equipment and material. Nevertheless, those accidents result in injuries could especially receive the greatest attention.

The United States Department of Labour defines an accidents as ‘any unexpected or unforeseen occurrence that interrupts or interferes with the orderly progress of the activity in question.’ In Canada, the Workmen’s Compensation Act, Ontario(1970) defines an accidents as “a chance event occasioned by a physical or natural cause.” However, there is no general legal definition of an accident in Hong Kong. There is only specific definition of accidents in individual section. Under the Boilers and Pressure Vessels Ordinance (Chapter 56), an accident means “an explosion of a boiler in pressure vessel in any part of a boiler or pressure vessel and renders it liable to explode or collapse or is calculated to weaken it and renders it liable to explode or collapse”.

Although accident is not legally defined in Hong Kong, there is a related term under the Employees’ Compensation Ordinance (Chapter 282). In the ordinance, it says reportable accident is one when injured or sustains fatal injury arising out of or in the course of his employment.


2.2 Cost of Accidents

There are both direct cost and indirect cost of accidents.

Direct costs of accidents are those directly attributed to or associated with injuries. Direct costs include cost of ambulance service, medical and ancillary treatment, medication, hospitalization, disability benefits and lost wages of injured workers. These costs are usually covered by workers’ compensation insurance policies. Compensation to the injured workers is also one of the costs to the company. Since an accident not only implies personal injuries, loss due to the damages of equipment or material is also one of the direct costs of accidents.

Indirect cost of accident are usually related to the lost of productivity and added administrative effort. Productivity will be immediately affected once accident occurs. A study of 582 medical case injuries, the lost productivity of the injured worker on the day of the injury was 3.7 hours. An additional 8 hours of productive work would be lost, due to the injury of the worker after the day of accident. Upon returning to work, it was further estimates that the worker might not be as productive as was he did before the accident occurred. Further more, the crew would be affected by the injured worker who was receiving treatment. Firstly, the crew is forced to work shorthanded. Obviously, this

---

results less drops of productivity of the crew.

Secondly, the supervisory personnel like site manager and safety manager will be responsible to ensure that treatment for the injured worker is promptly acquired. It was estimated that approximately 2.7 hours of supervisory time were consumed for each of accident.⁵

<table>
<thead>
<tr>
<th>Involved parties</th>
<th>Indirect cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Injured worker</td>
<td>3.7 productive hours on the day of injury</td>
</tr>
<tr>
<td></td>
<td>8 productive hours subsequent to the day of injury</td>
</tr>
<tr>
<td>Transporting the worker</td>
<td>3 productive hours on the day of injury</td>
</tr>
<tr>
<td></td>
<td>3 hours of vehicle time and mileage</td>
</tr>
<tr>
<td>Crew costs</td>
<td>12 hours lost by reduction of a crew from 5 to 4</td>
</tr>
<tr>
<td>Workers idled by watching</td>
<td>5 hours of other worker’s time</td>
</tr>
<tr>
<td>Damaged material</td>
<td>2 hours of work time to repair</td>
</tr>
<tr>
<td></td>
<td>2 hours of work time to restore work condition</td>
</tr>
<tr>
<td>Replacement worker</td>
<td>0.06 hours of lost productivity</td>
</tr>
<tr>
<td>Supervisory time</td>
<td>2.7 hours to assist injured worker</td>
</tr>
<tr>
<td></td>
<td>1.5 hours to investigate the accident</td>
</tr>
<tr>
<td></td>
<td>1 hour to complete the report</td>
</tr>
</tbody>
</table>

Table 4. Summary of indirect cost related to medical case injuries (Source :Hinze 2000)

⁵ Coble, Hinze and Haupt, 2000, Construction Safety and Health Management, Upper Saddle River: Prentice Hall Inc
One of the papers written by Heinrich (1941) listed the following indirect costs:

1. cost of lost time of injured worker
2. cost of lost time of other workers who stop work
3. cost of time lose by foreman, supervisors, or other executives
4. cost of time spent on the case by first-aid attendant and other staff
5. cost due to damage to equipment, tools, property, and materials
6. incidental cost due to interference with production
7. cost to employer under employee welfare and benefit system
8. cost to employer for continuing wages of injured worker
9. cost due to loss in profit due to reduced worker productivity
10. cost due to loss in profit due to idle equipment
11. cost incurred because of subsequent injuries partially caused by the incident
12. cost of overhead (utilizes, telephone, rent, etc.)

Since accidents are associated with undesirable cost, both direct and indirect costs, it generated another terminology: the cost of safety.

The cost of safety are those cost incurred as a result of emphasizing safety issue, including personal protective equipment and safety programme.

Construction practitioners usually focus only on the cost of safety rather than the cost of accident. They ignore safety issue to reduce the cost of safety. However, the direct and indirect cost of accident may override the cost of safety, which result a greater lost suffered by the company.
2.3 Causation of Accidents

There are many different theories associated with the cause of accidents. These accident causation theories illustrate human variables or workplace factors that can result in accidents in different dimensions. The knowledge and awareness of these theories prepare the professional to recognize and communicate organizational safety problems.

In this chapter, some of those theories would be discussed as follow:

1. Single Factor Theory

2. Domino Theory

3. Heinrich’s Domino Theory

4. Bird and Loftus’ Domino Theory

5. Marcum’s Domino Theory

6. Multiple Factors Theory

7. Goals Freedom Alertness Theory

8. Motivation Reward Satisfaction Model

9. Human Factor Theory

10. Energy-release Theory

11. Accident-proneness Theory

12. Adjustment-stress Theory

13. Distractions Theory
Chapter 2 Literature Review on Accidents

2.3.1 Single Factor Theory\textsuperscript{6}

The single factor theory states that there is only one single and relatively simple cause for all accidents. This theory Underestimates other contributing factors such as the product or the work methods, as well as corresponding corrective actions. This drawback affects the usefulness of this theory to prevent accidents and lose. Unfortunately, the single factor theory often represents the thinking of some in management level.

2.3.2 Domino Theory\textsuperscript{2}

All domino theory are divided into three phases, the pre-contact phase, the contact phase, and the post-contact phase.

The pre-contact phase refers to those events or conditions that lead up to the accidents during the contact phase. For example, the individual machinery, or facility comes into “contact” with the energy forms or forces that are beyond their physical capability.

The post contact phase refers to the results of the accident or energy exposure, for example physical injury, damage to equipment or facility and loss in reputation. These mentioned above are the possible results that can occur during the post contact phase of the domino theory.

In domino theories each causal factor builds upon and affects the others. If allowed to exist without any form of intervention, these hazards will then interact to produce the accident.

2.3.3 Heinrich’s Domino Theory

The domino theory of accident causation was originally developed by H W Heinrich in the late 1920s. His work is the basis for several contemporary theories in accident causation. According to Heinrich’s early theory, the following five factors influence all accident and represented by individual domino: fault of person, unsafe practice, unsafe condition, accident and loss.

In 1930, Heinrich was working for an insurance company as an engineer in the USA. He analyzed 75,000 accident reports, and attempted to develop a chronological sequence of inter-connected causal of accidental injury (Heinrich 1959)⁸.

Heinrich’s model was criticized for too focus on the immediate circumstances surrounding accidents, when it is now recognized that unsafe acts and conditions have systemic and organizational causes.

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2.3.4 Bird and Loftus’ Domino Theory

Like Heinrich’s theory, the Bird and Loftus domino theory emphasizes that the contact incidents can be avoided in unsafe acts and conditions are prevented. However the theory, Bird and Loftus(1976), updated the domino sequence to reflect the management’s relationship associated with the causes and effects of all incidents.

Bird and Loftus’s theory uses five dominos that represent the following events involved in all incidents:

1. Lack of Control

Control refers to the four functions of a manager: planning, organizing, leading, and controlling. Lack of control can be in different forms, for example purchasing substandard equipment or tools, not providing adequate training, or failing to install adequate engineering controls.

2. Basic cause

There are two factors personal factors and job factor of cause. Personal factors can be lack of knowledge or skill, improper motivation, and physical or mental problems. For job factors, it including inadequate work standards, inadequate design or maintenance, normal tool or equipment wear and tear, and abnormal toll usage such as lifting more weight than the rated capacity of an overhead crane.

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3. immediate cause

Unsafe acts and unsafe conditions are the immediate cause of accident.

4. incident

“an undesired event that could or does make contact with a source of energy above the threshold limit of body or structure” (Bird and Loftus, 1976). There are 11 types of contact incident event as follow: struck-by, struck-against, contact-by, contact-with, caught-in, caught-on, caught between, foot-level-fall, fall-to-below, overexertion and exposure.

5. people-property-loss

These are the adverse results of the accidents.

2.3.5 Marcum’s Domino Theory\textsuperscript{10}

Like the Bird and Loftus theory of accident causation, Marcum focused upon management responsibility for protecting employee safety as well as preventing the downgrading of an organization. Further more, the losses that result from harmful contact incidents were examined in more detail. This theory attempted to examine management emergency response protocols to ensure that sustained losses and costs were minimized.

2.3.6 Multiple Factors Theory\(^1\)

Grose’s multiple factors theory uses four “M” s to represent the factors that cause an accident, they are Machine, Media, Man and Management.\(^{(Brauer 1990)}\)\(^1\)

The multiple factor theory examines characteristics of the four M’s. For machinery, design, shape, size, or specific type of energy used to operate the equipment are examined. Men are psychological variables, and cognitive attribute. Management could be safety rules, organizational structure, or policy and procedures.

The multiple factor theory states that every accident can be preceded by more than one event. When one of the factors is absent, there is no injury but when all are present an injury is the most probable outcome.

2.3.7 Goals Freedom Alertness Theory\(^1\)

Goals freedom alertness theory was developed by Dr Willard Kerr. This theory regarded an accident as a low-quality work behavior. Accident is similar to production waste during manufacturing. If the level of worker awareness increases, the level of quality and safety rate arises also. According to Kerr, alertness can only be obtained within a positive workplace climate. The more positive the workplace climate, the greater the level of alertness and work quality. As this state of alertness decrease, there is an increased

\(^{11}\) Brauer, R L, 1990, Safety and Health for engineers, New York: Van Nostrand Reinhold
probability of an accident. The goals-freedom-alertness theory states that safe work performance is the result of a psychologically rewarding work environment.

Kerr believes that” great freedom to set reasonable attainable goals is accompanies typically by high quality work performance.” He claimed that a climate ‘richer’ in diverse economic and non-economic opportunities will be associated with the achievement of a higher level of alertness. That alertness will result in high-quality work and accident-free behavior.

The essence of the theory is that management should let a worker have a well defined goal and should give the worker the freedom to pursue that goal. The result will be that the worker focuses on the task that leads to that goal. The worker’s attentiveness to the job will reduce the probability of being involved in an injury. In one study, Kerr (1950) concluded that more injuries in one firm occurred in the departments with the lowest intercompany transfer rates and those with the lowest promotion potential, he concluded that workers with little chance of transfer or promotion would develop attitudes of relative indifference to their work environment. The indifference would lead to lowered alertness and more accidents.

12 Kerr, W 1950, Accident Proneness of Factory Department, Journal of Applies Psychology 34: 167-70
Chapter 2 Literature Review on Accidents

There are two stages in this model, danger build-up and danger release. The danger build-up stage refers to a situation in which the possibility of injury is present. In the danger build-up stage, if danger warnings are perceived and recognized, and decision is made to avoid the danger and the person is physically able to avoid the danger, then the result will be no hazard.

In the second stage, the accident has already occurred. The potential victim’s response to this situation is determined by his or her perception of the imminent danger, decision as to how to respond.

This model is useful for determining the source of human errors involved in accidents and helps to differentiate between errors arising as a result of lapses in concentration and those resulting from incorrect knowledge or errors of judgment.

2.3.8 Motivation Reward Satisfaction Model

This theory builds based on Dr Willard Kerr’s Goals Freedom Alertness theory. (Heinrich et al. 1980) stated “freedom to set reasons ably attainable goals is typically accompanied by higher –quality work performance”\(^13\). If an accident occurs, according to this theory, it is due to alertness. Factors affect these variables will either promote or prevent accidents. Because motivation is influenced by multiple variables, for example

job safety. Money or praise is not considered to be the primary motivation factors. Rewards can be in form of doing a good job, learning new skills, expanding personal knowledge, and being a member of a successful team.

2.3.9 Human Factor Theory\textsuperscript{14}

The human factor theory is based on the concept that accidents are the result of human error. Factors that cause human error are: overload, inappropriate activities and inappropriate response.

Overload means a person is burdened with excessive tasks or responsibilities. Inappropriate activities are usually due to not properly trained. Inappropriate response is resulted when an employee detects a hazardous condition but does not correct it.

2.3.10 Energy-release Theory\textsuperscript{8}

Accidents occur when energy is out of control which means putting more stress on a person or property than they can tolerate. The energy involved or changing the structure that the energy could damage. Haddon and Johnson focus on energy as the source of the hazard. By identifying the energy sources and preventing or minimizing the exposure, accidents will be prevented.

2.3.11 Accident-proneness Theory\textsuperscript{15}

This theory focused on personnel factors related to accident causation. It is assumed that when several individuals are placed in similar conditions, some will be more likely than others to sustain an injury. That sustaining an injury is not simply a chance occurrence. Farmer and chambers (1929) defined accident proneness as “a personal idiosyncrasy predisposing the individual who possesses it in a marked degree to a relatively high accident rate.” This theory has the underlying assumption that even when exposed to the same conditions, some people are more likely to be involved in accidents because of “their innate propensity for accidents” (Shaw and Sichel 1971).

Dahlack (1991) referred to accident proneness as a personality trait. Since risk taking is not a permanent or fixed trait, accident proneness might then change over time.

2.3.12 Adjustment-stress Theory\textsuperscript{13}

The adjustment-stress theory states that safe performance is compromised by a climate that diverts the attention of workers. The theory was developed to explain the remaining variance to complement the goals-freedom-alertness theory. The adjustment-stress theory contends that “unusual, negative, distracting stress” placed on workers increase their “liability to accident or other low quality behavior: (Kerr 1957)\textsuperscript{16}

Chapter 2 Literature Review on Accidents

This theory states that negative factors in the worker’s environment create diversions of attention and that the lack of attention can be very detrimental to safety. According to the adjustment-stress theory, the factors that divert attention and increase the probability of an accident may be brought to the job, or they may be generated on the job. The mental diversions created or generated on the job are of primary importance to managers, as it is the practices and policies of managers that are often the source of such on-the-site job stress. Such stress may arise from unrealistic demands placed on workers. The two common sources of such mental diversion include pressure to keep cost below some level that may nor be realistic and pressure to meet an unrealistically tight deadline.

Stress can be from the source outside the job e.g. family.

2.3.13 Distractions Theory

The distractions theory states that safety is situational. It is assumed that workers want to succeed in accomplishing their assigned tasks. The theory focuses on task achievement will stop once an injury occurs. According to this constraint, the worker has the greatest probability of accomplishing a given task when the worker’s focus on the distraction is minimal. Conversely, the probability of task achievement is minimal when there is a high level of focus on the distractions posed by the hazards.

Distractions theory simply points out that productivity is compromised when the
distraction due to hazards is high. However, the attention paid to the hazard is a form of
distraction. The way to improve the productivity is not to reduce the focus on the hazards,
but to remove or reduce those hazards. Since the hazard is no longer posing a serious
threat to the worker, the distraction is not as intense, and consequently task achievement
is not compromised to any great extent.
2.4 Conclusion

To conclude, Table shows the key factors behind each causation theory. Accidents are the result of one or more factors. Most of the theories revealed that human factor as the crucial part for formation of accidents.

<table>
<thead>
<tr>
<th>Accident Causation Theory</th>
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</tr>
</thead>
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</tr>
<tr>
<td></td>
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<td>Bird and Loftus’ Domino Theory</td>
<td>Five dominos: lack of control, basic cause, immediate cause, incident and people-property-loss</td>
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<tr>
<td>Marcum’s Domino Theory</td>
<td>Management responsibility for protecting employee safety and prevent downgrading of an organization</td>
</tr>
<tr>
<td>Multiple Factors Theory</td>
<td>Four Ms: machine, media, man and management</td>
</tr>
<tr>
<td>Goals Freedom Alertness Theory</td>
<td>Safety performance is the result of a psychologically rewarding work environment</td>
</tr>
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<td>Motivation Reward Satisfaction Model</td>
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## Chapter 2 Literature Review on Accidents

### Accident Causation Theory

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Table 5 Comparison of the accident causation theories
Chapter 3. Current Situation of Safety Performance in Construction Industry

3.1 Construction Industry in Hong Kong

Hong Kong is a prosperous cosmopolitan city and construction is requisite for its blooming economy. Although Hong Kong is undergoing economic restructuring, construction industry still maintain its importance to the Hong Kong economy. According to the Census and Statistics Department, construction industry contributes around 3% to the GDP, which is the third highest after the service sector. Furthermore, 24.4% of the workforce engaged in the construction industry in 2005, which is the second highest in all industries.

Construction safety is always high on the agenda of the government. Though there is a continuous improvement over the past few years, the industrial accidents rates of the construction industry is still higher than other industries. (Fig 1.)

![Industrial Accident Rates per 1 000 Workers by Selected Industries 1996-2005](Labour Department)

Fig 1. Industrial Accident rates per 1000 workers by Selected Industry 1996-2005 (Labour Department)

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18 Occupational Safety and Health Statistic Bulletin Issue. No.6, Labour Department
Chapter 3 Current Situation of Safety Performance in Construction Industry

In 2005, construction accidents contribute 86.21% of the total fatal cases in all the industry undertaking. Fig 2 shows the number of industrial fatalities and fatality rate per 1000 workers in construction industry from 1996 to 2005\(^\text{19}\). The fatality rate in the construction industry remain high this few years.

Fig 2. Number of Industrial Fatalities and Fatality Rate per 1000 workers in Construction Industry 1996 to 2005 (Labour Department)

\(^{19}\) Occupational Safety and Health Statistic Bulletin Issue. No.6, Labour Department
3.2 Accident rate in Hong Kong comparison with other countries

The main difference between the construction industry in Hong Kong and other countries is that Hong Kong’s construction industry is a mix of high-technology and traditional methods. It is not difficult for you to find bamboo scaffolding outside a 30-stoery-tall building. The construction safety record is poor when comparing to the international standard.

Although improvement can be observed these few years, the accident per 1,000 workers per year still stands high above 50. In other country like Japan, the figures keeps around 6-10 accidents per 1,000 workers per year. Thus, the figure in Japan is 5 times less than that in Hong Kong. United Kingdom is another examples, the accident rate is kept below 50 accidents per 1,000 workers per year.

![Accidents Per 1,000 Construction Workers Per Year](image)

Fig 3. Accident rate in Hong Kong, Japan and UK

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20 Japan Statistical Yearbook, Statistics Bureau & Statistical Research and Training Institute; Chapter R: Social Security, Health and Medical Care, Ministry of Health, Labour and Welfare; Japan International Centre for Occupational Safety and health (JICOSH); Health & Safety Executive, UK; Office for National Statistics of the united Kingdom
3.3 Safety management system in Hong Kong

Rowlinson (2003) regards safety as an integral part of the management process of a construction project. In order to achieve safety working environment, safety management system is essential.

In July 1995, a comprehensive review is conducted by the Manpower and Education Bureau on the industrial safety and fitting out of Hong Kong’s long-term safety strategies. The review recommend the Government to provide a framework within which self-regulation was to be achieved through a company system of safety management. Cheung P.C.C.(2004) stated that the system basically follows the Quality Assurance System in which it asks the top management of construction firms to define, document and implement a safety management system which includes safety training, formation of safety committee, implementation of safety audit, setting up a safety benchmark, etc.

According to the Labour Department, the objectives of setting up a safety management system are as follows:
- to prevent improper behavior that may lead to accidents
- to ensure problems are detected and reported
- to ensure accidents are reported and handled properly

The safety management system is included in the Factories and Industrial Undertakings (Safety Management) Regulation passed on 24 Nov 1999. According to the Section 8 of the Safety Management Regulation states that” A proprietor or contractor of a relevant industrial undertaking shall develop, implement and maintain in respect of the relevant industrial undertaking a management system which contains the elements applicable to that undertaking.”
Chapter 3 Current Situation of Safety Performance in Construction Industry

As defined in the Safety Management Regulation, the meaning of “safety management:” refers to the management functions connected with the carrying on that relates to the safety of personnel including

a. the planning, developing, organizing, and implementing of a safety policy
b. the measuring, auditing, or reviewing of the performance of those functions

3.3.1 Develop a safety management system

Planning and developing are the two processes of the development of a safety management system.

Planning

Planning is the process of determining in advance what should be accomplished. At this stage, the contractor is required to identify in advance what safety and health objectives should be accomplished by a safety management system as appropriate under the Safety Management Regulation. Then, the contractor has to prioritize the safety and health objectives and determine the ways and means to achieve them.

In order to identify the objectives, the contractor should conduct an initial status analysis of the existing arrangements for managing safety and health. Performance standards and periodic status analyses should be established and conducted in order to monitor the performance of the safety management in operation. Furthermore, risk assessment should also be carried out to decide on priorities and objectives for hazard elimination and risk control. The two major considerations in assessing “risk” are the severity of the hazard and the probability of loss/injury caused by the hazard. Based on the results of the assessment, it is possible to establish the business policy with the lowest risk.
The five steps of “risk assessment” are as follows:21

1. Identify the hazard in the workplace and in the nature of the work, estimate the severity of the hazards and the probable losses / injuries that they will bring, then determine the level.

2. estimate the degree of probable loss of life and property

3. evaluate whether the existing precautions are sufficient to eliminate the “risk” or reduce it to minimum to avoid losses/ injuries or death, or whether safety measures should be enhanced

4. recorded the results of each assessment including precautions already adopted or required to be enhanced, and inform all employees on the findings

5. conduct regular review of the assessment and revise when necessary

**Developing**

After planning the appropriate safety management system, the next step is developing. Developing is the process of determining how the safety and health objectives should be realized.

At this stage, the contractor is required to define, document and endorse a safety policy to spell out the safety and health objectives identified at the planning stage. The policy should include a commitment to achieve a high standard of occupational safety and health in compliance with legal requirements and trade practices for continuous improvement. Adequate resources should be provided to implement the policy. An effective safety plan should be prepared for carry out the safety policy. In the safety plan, clear direction and series of action should be clearly stated and clear guidance should be provided for managers and workers to work together to achieve the objectives of the safety policy.

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21 Occupational Safety and Health Management in Renovation and Maintenance Works for the Property Management Industry, 2006, Labour Department
3.3.2 Implement a safety management system

The implementation of a safety management system involves organizing and implementing.

Organizing

Organizing means that prescribing formal relationships between people and resources in the organization in order to achieve objectives. At this stage, the contractor should ensure all employees have the necessary authority to carry out their safety and health responsibility and to make arrangement for employees at all levels to take part in safety and health activities.

Implementing

Implementing is the process of carrying out or putting into practice the plans to achieve the desired objectives, with appropriate and adequate control to ensure proper performance in accordance with the plans. The contractor should determine and execute operation plans to control the risks identified and to meet the legal requirement as well as other requirements regarding safety management. Adequate and effective supervision should be provided to ensure that the policies and plans are effectively implemented.
3.3.3 Maintain a safety management system

Maintenance of a safety management system involves measuring and auditing or reviewing, thus the contractor can know whether the safety management system is working well or needs improvement, therefore maintaining the system in an efficient and effective state.

Measuring

Measuring means that checking performance against preset standards in order to find out whether improvement is needed. The measuring stage provides a “feedback loop” for the stages of development and implementation of a safety management system and help to reinforce and maintain its ability to reduce risk and to ensure the continued efficiency, effectiveness and reliability.

Auditing/ reviewing

Apart from routine monitoring the occupational safety and health performance, auditing or reviewing is essential to assess the performance of the system. Safety audit and safety review includes collecting, assessing and verifying information on the efficiency, effectiveness and reliability of a safety management system. Auditing or reviewing constitutes the “feedback loop” to the planning stage which reinforce, maintain and develop ability to reduce risks and ensure the continued efficiency, effectiveness and reliability if the safety management system. In addition, there should be information flowing between the development, implementation and maintenance stages and the auditing or reviewing stage so as to ensure the correct operation of the safety management system.
The development, implementation and maintenance of a safety management system can be summarized by the following flow chart:

![Management model to develop, implement and maintain a safety management system](image)

**Legend**

- **Information link**
- **Control link**

*Fig 4. Management model to develop, implement and maintain a safety management system, Code of practice on safety management, Apr 2002, Occupational safety and health branch, Labour department*
3.3.4 The elements of a safety management system

According to the code of practice on safety management, there are 14 elements of a safety management system, they are as follows:

a. A safety policy which states the commitment of the proprietor or contractor to safety and health at work
b. A structure to assure implementation of the commitment to safety and health at work
c. Training to equip personnel with knowledge to work safely and without risk to health
d. In-house safety rules to provide instruction for achieving safety management objectives
e. A programme of inspection to identify hazardous conditions and for the rectification of any such conditions at regular intervals or as appropriate
f. A programme to identify hazardous exposure or the risk of such exposure to workers and to provide suitable personal protective equipment as a last resort where engineering control methods are not feasible
g. Investigation of accidents or incidents to find out the cause of any accident or incident and to develop prompt arrangements to prevent recurrence
h. Emergency preparedness to develop, communicate and execute plans prescribing the effective management of emergency situations
i. 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
j. Safety committees
k. Evaluation of job related hazards or potential hazards and development of safety procedures
l. Promotion, development and maintenance of safety and health awareness in a workplace
m. A programme for accident control and elimination of hazards before exposing workers to any adverse work environment

n. A programme to protect workers from occupational health hazards.

In this chapter, 4 safety measures commonly adopted in Hong Kong will be discussed, they are Safety Charter, Pay for Safety Scheme, OHSAS 18001 and Safety Working Cycle.

### 3.3.5 Safety Charter

In 1996, the Labour Department and the Occupational Safety & Health Council joint and launch the “Occupational Safety Charter”. It aimed to encourage employers and employees to work together to create and maintain a safe and healthy work environment basing on “a spirit of self regulation”.

Safety charter is a written document highlighting the commitment of both the employers and employees in creating and maintaining a safe and healthy work environment. It spells out the responsibilities of various parties. The Government highly encourages employers to establish a safety charter and use it as basis for constructing a safety management system.

Employers should work together with their employees to plan, communicate, implement and evaluate their own version of the system for maximum impact and effectiveness at their workplace.
Advice and guidance are provided by the Labour Department and the Occupational Safety and Health Council, their supports are as follows:

1. Advice and encouragement for enterprises on how to comply with statutory requirements, and arrangements for occupational health and hygiene matters.
2. Training and education accrediting and monitoring safety training organizations, organizing course, seminars and workshops.
4. Publicity & promotion- promoting safety culture through mass media and other channels.
5. Research, safety audit and consultancy services

The Occupational Safety and Health Council defines a few areas of a safety management system, they are as follows:

Policy- it defines employer’s commitment to communicating, implementing and maintaining a safe workplace.

Planning- it ensure projects are reviewed at the design stage so as to minimize future risks. It also ensures plans are in place to deal with emergencies safety and effectively.

Procedures- they make sure employees understand clearly the in-house safety rules and regulations, and their obligation.

Investigations- they ensure all accidents and incidents at work are analyzed, conclusion are properly drawn and appropriate action taken.

Subcontracting- it governs the responsibilities of your contractors, so that they are fully aware of, and are capable of meeting your organization’s safety management obligations.
3.3.6 Pay for Safety Scheme

Construction site safety is normally referred as general obligation in the General Contract and by some all-embracing preliminaries or preamble wording. However, there is no separate and clear identifiable sum in the tender rates and price for safety measures. This results at when money is tight, contractor may try to cut corners on site safety.

In January 1993, the Works Group Directors Meeting WGDM agree to allow a limited trial in three construction contracts by the inclusion of a schedule of fully specified safety related items, there were pre-priced in the Bills of Quantities (BQ) by the Engineer/Surveyor. These items would be certified and paid to contractor, provided that the specified activities were satisfactorily performed. After reviewing the three contracts, it was agreed in principle that the Pay for Safety Scheme (PFSS) should be developed for general use in BQ based contracts. Then, the PFSS is launched in most of the public project since April 1996.

According to the report of ETWB 2000, the objective of PFSS is to remove site safety from the realm of competitive tendering and it has support the construction industry.

3.3.7 Independent Safety Auditing Scheme (ISAS)

Independent Safety Auditing Scheme (ISAS) was developed by the OSHC and initiated by ETWB in 1996. The audit system delineated fourteen key process elements for monitoring the safety performance of the contractors’ management. ISAS runs in conjunction with PFSS. Stated in the ETWB report 2000, audits under the ISAS were carried out on quarterly. Payment for the ISAS “Safety Audit” item will depend on the Accredited Safety Auditor’s Report. If the report indicates that the score in both the contractor’s safety management system and the implementation of the Safety Plan in site are 70% or above, payment will then be certified in the next interim payment. Sample BQ for works contracts included in both PFSS and ISAS is illustrated in Appendix IV.
3.3.8 OHSAS 18001

OHSAS 18001 is an occupational health and safety assessment series for health and safety management systems. It aims to help an organization to control occupational health and safety risk. It is developed in response to demand for a recognized standard against which to be certified and assess. OHSAS 18001 was created under the effort of a number of national standards bodies, certification bodies and specialist consultancies, including National standard authority of Ireland, standards Australia, south African bureau of standards, British standards institution etc.

3.3.9 Safety Working Cycle

Safety Working Cycle (SWC) is introduced in 2000 to enhance construction industry safety. (Cheung, 2005) SWC aimed to develop a positive attitude through participation in various promotional activities on work sites to enhance safety awareness. Safety training, in particular toolbox talk and safety briefing, are key components of SWC and it has now been widely adopted among the local construction industry. Other SWC activities including the following:

- morning safety assembly
- morning safety exercise
- hazard identification activity
- prior-to-work inspection on equipment and electrical installation
- tidying up after work
- weekly site tidying up
- safety training
3.4 Legislation

Most of the Hong Kong’s safety and health legislation are based on the practice in the United Kingdom. The primary objective of the industrial safety legislation is to ensure a safe and healthy workplace is provided for workers.

In the past, the Hong Kong government control construction site safety by setting details rules for employers on how safety objective could be attained. Until 1978, a duty was imposed on both the employers and employee by Kong Construction Site (Safety) regulation. The regulation states that both the employers and employees are having the obligation to comply with the regulations to ensure the safety on site.

In the present construction safety policy, the Factories and Industrial Undertakings Ordinance (Chapter 59) is the principal legislation in Hong Kong to provide safety and health protection to workers in the construction industry. The FIUO and other related legislations are existed in use together with the self-regulatory safety management approach as a whole to performance a better safety policy.

3.4.1 The Factories and Industrial Undertakings Ordinance (Chapter 59)

The Factories and Industrial Undertakings Ordinance (FIUO)(Chapter 59) aims to provide safety and health protection to workers in the industrial sector. The ordinance applies to industrial undertakings, i.e. factories, construction sites, catering establishments, cargo and container handling undertakings, repair workshops and other industrial workplaces.

Rowlinson (2003) mentioned that the FIUO 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.” The original focus of FIUO was setting standards and
enforcement. However, in 1989, an amendment introduced the general duties provision to incorporate self-regulation. Thus it is not only the responsibility for employers to take all reasonable practicable steps to ensure the health and safety of employees at the workplace, workers should also bear the duties to exercise reasonable care at work and co-operate with the employers on safety measures.

“General duties” of proprietors are stated in section 6A (1) and (2) of the FIUO. Section 6A(1) states that it is the duty of every proprietor “to ensure so far as is reasonable practicable, the health and safety at work of all persons employed by him.” Section 6A(2) elaborated further on the nature of these duties in particular:

a. Every proprietor should take care of the safety and health at work of all persons employed by him at industrial undertaking by:
   ♦ Providing and maintaining plant and work systems that do not endanger safety or health
   ♦ Making arrangement for ensuring safety and health in connection with the use, handling, storage or transport of plant or substances
   ♦ Providing all necessary information, instruction, training and supervision for ensuring safety and health
   ♦ Providing and maintaining safe access to and agree from the workplaces
   ♦ Providing and maintaining a safe and healthy work environment

Section 6A (4) states that a proprietor of an industrial undertaking who contravenes this section willfully and without reasonable excuse commits an offence and is liable to a fine of $500000 and to imprisonment for 6 months.

b. Every person employed at an industrial undertaking should also contribute to safety and health at work by:
   ♦ Taking care for the safety and health of himself and other persons at the
workplace

- Using any equipment or following any system or work practices provided by the proprietor

The ordinance is enforced by the occupational safety and health officer of the Labour Department and there are 30 sets of subsidiary legislations under FIUO. These subsidiary regulations prescribe detailed safety and health standards on work situation, plan and machinery, processes and substances.

The 30 sets of regulations are as follows:

- CAP 59A Factories and Industrial Undertakings Regulations
- CAP 59B Factories and Industrial Undertakings (Confined Spaces) Regulations
- CAP 59C Factories and Industrial Undertakings (Blasting by abrasives) Special Regulations
- CAP 59D Factories and Industrial Undertakings (First Aid in Notifiable Workplaces) Regulations
- CAP 59E Factories and Industrial Undertaking (Notification of Occupational Diseases) Regulations
- CAP 59F Quarries (Safety) Regulations
- CAP 59G Factories and Industrial Undertakings (Woodworking Machinery) Regulations
- CAP 59H Factories and Industrial Undertakings (Electrolytic Chromium Process) Regulations
- CAP 59I Construction Sites (Safety) Regulation
- CAP 59J Factories and Industrial Undertakings (Lifting Appliances and Lifting Gear)
Chapter 3 Current Situation of Safety Performance in Construction Industry

Regulations

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

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

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

♦ CAP 59N Factories and Industrial Undertakings (Spraying of flammable Liquids) Regulations

♦ CAP 59O Factories and Industrial Undertakings (Goods Lifts) Regulations

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

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

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

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

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

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

♦ CAP 59W Factories and Industrial Undertakings (Electricity) Regulations

♦ CAP 59X Factories and Industrial Undertakings (Asbestos) Special Regulations

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

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

♦ CAP 59AB Factories and Industrial Undertakings (Dangerous Substances) Regulations
Chapter 3 Current Situation of Safety Performance in Construction Industry

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

♦ CAP 59AD Factories and Industrial Undertakings (Asbestos) Regulation

3.4.2 Construction workers registration ordinance (Chapter 583)

Construction Workers Registration Ordinance (Chapter 583) is an ordinance to provide for the registration of construction workers. It states the establishment of a Construction Workers Registration Authority. The authority should be responsible for the administration of the Ordinance and the supervision of the registration of persons.

The objectives of the mandatory registration policy are as follows:\(^\text{22}\)

♦ Ensure the quality of construction work 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

♦ Foster a quality culture in the construction industry by providing the workers with a clear career path, motivating them to aim for higher skill levels, thus higher status and more income

♦ 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 the combating the hiring of illegal workers in construction sites

♦ Ensure the availability of site entry and exit records that may assist in resolving

\(^{22}\) Legislative Council Brief, Construction Workers Registration Bill, ETWB(CR)(W)150/101, 25 Feb 2003, Executive Council, HKSAR
some of the wage disputes between the contractors and the workers.

3.4.3 Occupational Safety and Health Ordinance (Chapter 509)

Occupational Safety and Health Ordinance (Chapter 509) came into effect on May 23, 1997. The ordinance aims to ensure the safety and health of persons when they are at work. Unlike the FIUO which applies only to factories and the industrial environment, the ordinance requires wider scope of employers to ensure the safety and health of employees.

According to the Department of Justice, the purposes of this ordinance are as follows:

a. to ensure the safety and health of employees when they are at work
b. to prescribe measures that will contribute to making the workplaces of employees safer and healthier for them
c. to improve the safety and health standards applicable to certain hazardous processes, plant and substances used or kept in workplaces
d. generally improve the safety and health aspects of working environments of employees

3.4.4 Other Ordinances and Regulations Related to Construction Safety

Apart from the Factories and Industrial Undertakings Ordinance (Chaper 59), the Construction Workers Registration Ordinance (Chapter 583) and the Occupational Safety and Health Ordinance (Chapter 509), there are other ordinances and regulations related to construction safety.

These ordinance and regulations are as follows:

- Fatal Accidents Ordinance (Cap.22)
- Gas Safety Ordinance (Cap51)
Chapter 3 Current Situation of Safety Performance in Construction Industry

- Boilers and Pressure Receivers Ordinance (Cap. 56)
- Employment Ordinance (Cap.57)
- Legal Aid Ordinance (Cap. 91)
- Fire Services Ordinance and Regulations (Cap. 95)
- Building Ordinance and regulations (Cap.123)
- Public Health and urban Services Ordinance (Cap. 132)
- Watchman Ordinance and Regulations (Cap.209)
- Summary Offences Ordinance and Regulations (Cap.228)
- Employee’s Compensation Ordinance and regulations (Cap. 282)
- Dangerous Goods Ordinance and Regulations (Cap. 295)
- Radiation Ordinance and Regulations (Cap. 303)
- Air Pollution Control Ordinance (Cap.311)
- Industrial Training (Construction Industry) Ordinance (Cap. 317)
- Waste Disposal Ordinance (Cap. 354)
- Water Pollution Control Ordinance (Cap. 358)
- Pneumoconiosis (Compensation) Ordinance and Regulations (Cap. 360)
- Road Traffic (Traffic Control) Regulations (Cap. 374)
- Noise Control Ordinance and Regulations (Cap. 400)
- Electricity Ordinance and Regulations (Cap. 406)
- Builder’s Lift and Tower Working Platforms (Safety) Ordinance (Cap. 470)

3.5 Training

Construction Industry Training Authority (CITA) is the main provider of craft training for the construction industry and safety-related courses. CITA was established in 1975 by the enactment of the Industrial Training (Construction Industry) Ordinance Cap 317. The
Statutory functions of the Authority are:

♦ To establish and maintain industrial training centres
♦ To provide training courses for the construction industry
♦ To assist in the placement of persons completing training courses
♦ To make recommendations with respect to the rate of training levy

Most of the safety related courses are conducted by the Management Training and Trade Testing Centre, some of them are listed below:

♦ Construction Safety Officer Course
♦ Effective Site Safety Training and Instructing Techniques Course
♦ Site Foreman Safety Training Course
♦ Safe Working Cycle Course
♦ Safety Training Techniques Course
♦ Refresher Course for Construction Safety Officers
♦ Basic Accident Prevention Course
♦ Construction Safety Supervisor Course
♦ Mandatory Basic Safety Training Course
♦ Mandatory Basic Safety Training Revalidation Course
♦ Safety Training Course for Construction Workers of Specified Trade
♦ Safety Training Revalidation Course for Construction Workers of Specified Trade
♦ Safety Training Course for Certified Workers of Confined Space Operation
♦ Revalidation Course for Certified Workers of Confined Space Operation

Over 800,000 workers were trained with these safety related course since the establishment to 2005.

<table>
<thead>
<tr>
<th>Summary of Training output for 2004-2005</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td>Safety Related Course</td>
</tr>
<tr>
<td>2004</td>
</tr>
<tr>
<td>43,420</td>
</tr>
<tr>
<td>2005 (upto 31/8/05)</td>
</tr>
<tr>
<td>32,437</td>
</tr>
<tr>
<td>From establishment upto 31/8/05</td>
</tr>
<tr>
<td>836,190</td>
</tr>
</tbody>
</table>

Chapter 3 Current Situation of Safety Performance in Construction Industry

Table 7. Construction Industry Safety Card and Silver Card course Progress report (Up to 31/1/06)

<table>
<thead>
<tr>
<th></th>
<th>No. of applicants</th>
<th>No. of withdrawal</th>
<th>No. of Attendees</th>
<th>No. of Card Holders</th>
<th>Passing rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safety Card</td>
<td>547,143</td>
<td>54,684</td>
<td>492,296</td>
<td>487,495</td>
<td>99%</td>
</tr>
<tr>
<td>Silver Card</td>
<td>36,003</td>
<td>3,999</td>
<td>31,944</td>
<td>31,757</td>
<td>99.4%</td>
</tr>
</tbody>
</table>

(Source: CITA 2006 Annual Report)

Occupational Safety and Health Training Centre under the Labour Department provides training course for personnel in public and private sectors. Some external training courses are also accredited by the Centre under the safety-related regulations administered by Labour Department.

The mandatory safety training of workers and certification of workers under occupational safety and health legislations and regulations are listed in the table below:
<table>
<thead>
<tr>
<th>Legislation</th>
<th>Section / regulation</th>
<th>Relevant Trainings in Occupational Safety and Health</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chapter 509A Occupational Safety and Health Regulation</td>
<td>20</td>
<td>Designed member as a first aider in a workplace</td>
</tr>
<tr>
<td>Chapter 59 Factories and Industrial Undertakings Ordinance</td>
<td>6BA</td>
<td>Mandatory Basic Safety Training (Green Card) for a person to be employed to carry out construction work</td>
</tr>
<tr>
<td>Chapter 59I Construction Sites (Safety) Regulation</td>
<td>63</td>
<td>Designated member as a first aider in a construction site</td>
</tr>
<tr>
<td>Chapter 59J Factories and Industrial Undertaking (Lifting Appliances and Liftings Gear) Regulations</td>
<td>15A(1)(b)</td>
<td>Operates crane in an industrial undertaking</td>
</tr>
<tr>
<td>Chapter 59R Factories and Industrial Undertakings (Cartridge operated Fixing Tools) Regulations</td>
<td>11(1)</td>
<td>Uses cartridge operated fixing tool in an industrial undertaking</td>
</tr>
<tr>
<td>Chapter 59W Factories and Industrial Undertakings (Electricity) Regulations</td>
<td>26(2)</td>
<td>Carries out electrical works in an industrial undertaking</td>
</tr>
<tr>
<td>Chapter 59AC Factories and Industrial Undertakings (Suspended Working Platform) Regulation</td>
<td>17(1)(b)</td>
<td>Operates suspended working platform in an industrial undertaking</td>
</tr>
<tr>
<td>Chapter 59AE Factories and Industrial Undertakings (Confined Spaces) Regulation</td>
<td>8(a)</td>
<td>Training as a “Certified worker” to carry out work in confined space</td>
</tr>
<tr>
<td>Chapter 59AG Factories and Industrial Undertakings (Loadshifting Machinery) Regulation</td>
<td>3(b)</td>
<td>Operates loadshifting machinery in an industrial undertaking</td>
</tr>
<tr>
<td>Chapter 59AI Factories and Industrial Undertakings (Gas Welding and Flame Cutting) Regulation</td>
<td>3(1)(a)</td>
<td>Carries on gas welding and flame cutting work in an industrial undertaking</td>
</tr>
</tbody>
</table>

Table 8. Occupational Safety and Health Management in Renovation and Maintenance Works for the Property Management Industry, *Occupational safety and health branch*  
*Labour Department*
Chapter 4. Safety performance of RMAA works in Hong Kong

4.1 Overview of RMAA works in Hong Kong

RMAA works is a new term in the construction industry. According to the Building Department, alterations and addition works include the followings:

- constructing a new extension block to an existing building;
- adding additional floors or cocklofts to an existing building;
- constructing a swimming pool;
- linking two or more floors by removal of parts of the floor slab and/or adding internal staircases;
- combining two or more units into one by removing the partition walls;
- installing cladding or curtain wall to the façade of existing building;
- subdividing a unit into smaller units;
- adding water tanks, canopies and shelters, structural frames for air-conditioning or other plant, structural supports for advertisement signboards etc; or
- removing facilities for persons with a disability.

According to the Hong Kong Yearbook 2004, the actual expenditure on public building projects on routine maintenance and minor alteration works were 2.42 billions.

Although the term “RMAA” is still quite green to the industry, these kinds of construction work will become more and more common and importance in the near future due to BMMS and MBIS.
Building Management and Maintenance Scheme (BMMS)

Hong Kong Housing Society launched Building Management and Maintenance Scheme (BMMS) in February 2005. The Housing Society signed a Memorandum of Understanding (MOU) with the Government on 20 January 2005, which stated that the society committing HK$ 3 billion fund to the BMMS for the next ten years. BMMS aims at encouraging owners of private buildings to manage and maintain their properties with the provision of knowledge, education and advice as well as financial support. Housing Society will subsidize qualified Owners’ Corporations (OCs) with 20% of the total repair costs or HK$3,000 per flat (whichever is lower) with regard to safety and hygiene issues in the buildings’ common areas. The society also offer a 50% subsidy of up to HK$6,000 a year towards public liability insurance in the common areas of buildings for the first three years after completion of works. With regard to elderly homeowners, the society with offer Home Renovation Loan Scheme which operates in conjunction with the Hong Kong Council of Social Services (HKCSS) which help individual owners to carry out necessary renovations and repairs with financial assistance and interest-free loans.

At the end of Mar 2006, 250 OCs had been formed, more than 300 buildings were given technical support, and about 240 applications have been received for building maintenance incentives together with 190 applicants for the HRLS.
Fig 5. BMMS applications (Source: Annual Report 2006, Hong Kong Housing Society)

**Mandatory Building Inspection Scheme (MBIS)**

According to Buildings Department, there are about 42,000 private buildings in Hong Kong. About 11,400 of them are 20 to 40 years old and are susceptible to maintenance problems.

In view of the seriousness of the problem, the Hong Kong government urges and assists building owners to form owners’ corporation (OC) under the Chapter 344 Building Management Ordinance (BMO). Subject to BMO, at the meeting of OC any resolution may be passed with respect to the control, management and administration the common area of buildings; or the renovation, improvement or decoration of those parts.  

However, there are still about 11,000 buildings without owners’ corporations and are not...

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23 Bilingual Laws Information System, Department of Justice
served by management firms. In view of this situation, the government introduced a Mandatory Building Inspection Scheme (MBIS).

MBIS serving as a long-term preventive approach which requires owners to inspect their buildings on a regular basis and carry out many necessary rectification works. Under MBIS, owners of private buildings aged 30 years or above are required to engage qualified inspectors to inspect their buildings every seven years and undertake necessary repair work as specified by the inspectors.

The Authorized Persons (APs) and Registered Structural Engineers (RSEs) regulated under the Buildings Ordinance will in charge the building inspections under MBIS. The rectification works will be carried by Registered General Building Contractors (RGBCs) and Registered Minor Works Contractors. (The creation of Registered Minor Works Contractors is subject to the passage of Minor Works legislation currently scheduled for introduction into the Legislative Council in 2006.)

Enhancing the window safety in private buildings is another focus of the MBIS. Falling of window incidents heightened the public concerns over window safety. In the first nine month of 2006, the number of reported cases of falling windows was 75, which exceed the total number of 46 for the whole of 2004. In most of the cases, the window failure is due to the lack of regular inspection and proper maintenance and improper use of windows. The window safety issue will be addressed by a separate scheme because of the unique nature of windows. Window failure can even be found in buildings which are much younger than 30 years old. The inspection cycle for windows will need to be much shorter than that of the 7 years proposed under the MBIS.

The drafting of the relevant legislation on the MBIS and a mandatory window inspection scheme will be commenced in 2007.
List of Inspection Items Under the Proposed Mandatory Building Inspection Scheme

<table>
<thead>
<tr>
<th>ELEMENTS</th>
<th>ITEMS TO BE COVERED</th>
</tr>
</thead>
<tbody>
<tr>
<td>External Elements</td>
<td>These are mainly non-structural elements such as fixtures, installations or appendages to the exteriors of buildings, regardless of whether they are commonly owned or privately owned by individual owners. Examples are:</td>
</tr>
<tr>
<td></td>
<td>i. External finishes such as wall tiling and rendering including finishes to hoods and surrounds</td>
</tr>
<tr>
<td></td>
<td>ii. Louvers (common parts only) and cladding</td>
</tr>
<tr>
<td></td>
<td>iii. Racks, awnings, planters, supporting platforms for air conditioners, eaves, mouldings, projections, architectural features, drying racks, railing, advertising signs etc</td>
</tr>
<tr>
<td>Structural Elements</td>
<td>i. Structural columns and walls on external elevations and in common parts</td>
</tr>
<tr>
<td></td>
<td>ii. Beams and slabs on external elevations and in common parts</td>
</tr>
<tr>
<td></td>
<td>iii. Roofs, above-ground transfer plates, and earth-retaining structures within common parts of a building</td>
</tr>
<tr>
<td></td>
<td>iv. Cantilevered structures on external elevations within common parts</td>
</tr>
<tr>
<td></td>
<td>v. Water tanks in common parts</td>
</tr>
<tr>
<td>Building Fire Safety Elements</td>
<td>Provisions for:</td>
</tr>
<tr>
<td></td>
<td>i. Means of escape in case of fire in common parts</td>
</tr>
<tr>
<td></td>
<td>ii. Means of access for firefighting and rescue in common parts</td>
</tr>
<tr>
<td></td>
<td>iii. Fire resisting construction and compartmentation in common parts</td>
</tr>
<tr>
<td>Drainage System</td>
<td>i. External drainage pipes, both common stacks and side branches serving individual units in private ownership</td>
</tr>
<tr>
<td></td>
<td>ii. Underground drainage system of the building in common parts</td>
</tr>
<tr>
<td>Other Physical Elements</td>
<td>i. Externally - those in common parts detached from the main building except retaining structure and slopes (e.g. club houses, guard houses)</td>
</tr>
<tr>
<td></td>
<td>ii. Internally - internal wall and floor finishes, ceiling finishes, metal works, doors, etc. within common parts</td>
</tr>
<tr>
<td>Unauthorized Building Works</td>
<td>All unauthorized building works whether in private ownership or encroaching into common parts of the building, which constitute an obvious or imminent danger to the occupants or the public and actionable under existing Buildings Department's enforcement policy</td>
</tr>
</tbody>
</table>

Table 9. List of Inspection Items Under the Proposed Mandatory Building Inspection Scheme

(Source: Public Consultation on Mandatory Building Inspection, Mar 2006, Housing, Planning and Lands Bureau)
Co-ordinated Maintenance of Buildings Scheme (CMBS)

Since November 2000, the Buildings Department (BD), in association with six other government department, including the Home Affair Department (HAD), Fire Services Department, Electrical and Mechanical Services Department, Food and Environmental Protection Department, has launched a Co-ordinated Maintenance of Buildings Scheme (CMBS) in various districts throughout Hong Kong to assist building owners and owners’ corporations (OCs) in pursuing a comprehensive building management and maintenance programme.24

The Building Management Ordinance was amended on 1 August 2000 to require that OCs should manage and maintain their buildings in accordance with the “Code of Practice on Building Management and Maintenance”, issued under the Ordinance by the Secretary for Home Affairs. The purpose of this Code is to publicize standards of management and maintenance of the common parts of buildings for compliance by owners, office-bearers of management committee of owners’ corporations (OCs), office-bearers of owners’ committees, managers, building managing agents, management companies and such other persons/bodies charged with the duty to manage the common parts of buildings.

The Code itself will have no direct enforcement effect. If the owners fail to comply with the Code may result in the Authority issuing an order under section 40B of the Building Management Ordinance subjecting the building to mandatory building management.

Under CMBS, a designated BD officer will assigned to act as the building coordinator for each of the target buildings. He will conduct a survey of the target buildings and determine the scope and nature of improvement works required. Joint enforcement action

24 Buildings Department, An Introduction to the Co-ordinated Maintenance of Building Scheme,
will be initiated with the other government departments when the building owners or OC not proceed with the required works within a reasonable period of time.

Since February 2005, the BD introduced a modified CMBS under which the HKHS provides technical support to owners in the carrying out of the necessary maintenance and repair works. The scheme aims to increase owners' awareness of the importance of timely building maintenance and encourage them to organize themselves to take up the responsibility in this regard. The modified scheme will cover 150 buildings in 2005. The BD also operates a $700 million Building Safety Loan Scheme\(^{25}\) to provide loans to private building owners for the carrying out of repair works or removal of unauthorized building works. The purpose of the Building Safety Loan Scheme is to provide loans to individual owners of all types of private buildings including domestic, composite, commercial and industrial buildings who may wish to obtain financial assistance in carrying out works for improving the safety of their buildings and/or private slope.

**Rehabilitation schemes**

Urban Renewal Authority is working with owners, government and other partners to prevent the decay of the built environment by promoting and facilitating the proper repair and maintenance of buildings. URA has launched different schemes to encourage the rehabilitation in the city, these schemes include: Building Rehabilitation Loan Scheme, Building Rehabilitation Materials Incentive Scheme, Third Party Liability Insurance Subsidy.

The URA has also agreed to enhance the assistance under its rehabilitation schemes, including -

\(^{25}\) Buildings Department, *An Introduction to the Building Safety Loan Scheme*, BDLS-20(Revised 1/2007)
i. raising the cost of materials incentive offered under the Materials Incentive Scheme from (not exceeding) 10% of works value or $3,000 per unit to (not exceeding) 20% or $3,000 per unit whichever is lower;

ii. extending the hardship grants of up to $10,000 per unit currently offered under the Building Rehabilitation Loan Scheme to eligible building owners under the Materials Incentive Scheme; and

iii. extending the professional fee subsidy of 50% (up to $20,000 per building) currently provided under the Materials Incentive Scheme to buildings under the Building Rehabilitation Loan Scheme.

The government is putting RMAA work in a higher and higher agenda. The Buildings Department is drawing up a new category of “minor works” to be carried out and certified by professionals and registered contractors without the need of approval of plans. A new register of “minor works contractors” will be created under the Building Ordinance. The department will then focus on more significant building works and on audit control. Any alteration or addition building works to be carried out, appointment of an authorized person is required by law. Building Ordinance requires a registered structural engineer to prepare and submit plans for the approval of Building Authority together with a registered contractor to carry out the building works.
4.2 Accident rate of RMAA works

Maintenance and repair works are now under the spotlight of the society. There is a growing concern for the increased accidents in these RMAA works. Statistics shows that the number of industrial accidents arising from RMAA works contributed over 30% of the accident toll in the construction industry in recent years. (Table 9)

<table>
<thead>
<tr>
<th>Year</th>
<th>All reported construction accidents</th>
<th>Accidents rate per 1,000 workers</th>
<th>All reported accidents in RMAA works</th>
<th>a. No. of reported accidents in RMAA works in Public sector sites</th>
<th>b. No. of reported accidents in RMAA works in private sector sites</th>
<th>Percentage of RMAA accidents to all reported accidents</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>11,925</td>
<td>149.8</td>
<td>3,401</td>
<td>475</td>
<td>2,927</td>
<td>28.5%</td>
</tr>
<tr>
<td>2001</td>
<td>9,206</td>
<td>114.6</td>
<td>2,582</td>
<td>331</td>
<td>2,251</td>
<td>28.0%</td>
</tr>
<tr>
<td>2002</td>
<td>6,239</td>
<td>85.2</td>
<td>1,925</td>
<td>250</td>
<td>1,675</td>
<td>30.9%</td>
</tr>
<tr>
<td>2003</td>
<td>4,367</td>
<td>68.1</td>
<td>1,485</td>
<td>158</td>
<td>1,327</td>
<td>34.0%</td>
</tr>
<tr>
<td>2004</td>
<td>3,833</td>
<td>60.3</td>
<td>1,454</td>
<td>104</td>
<td>1,350</td>
<td>37.9%</td>
</tr>
</tbody>
</table>

Table 10: Industrial Accidents of RMAA Works, Labour Department

Fatal industrial accidents of RMAA works also contributed a significant percentage of the fatal industrial accident toll in the construction industry. (Table 10)

<table>
<thead>
<tr>
<th>Year</th>
<th>All reported fatal construction accidents</th>
<th>New works</th>
<th>RMAA</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td></td>
<td>17</td>
<td>12</td>
<td>29</td>
</tr>
<tr>
<td>2001</td>
<td></td>
<td>24</td>
<td>4</td>
<td>28</td>
</tr>
<tr>
<td>2002</td>
<td></td>
<td>14</td>
<td>10</td>
<td>24</td>
</tr>
<tr>
<td>2003</td>
<td></td>
<td>17</td>
<td>8</td>
<td>25</td>
</tr>
<tr>
<td>2004</td>
<td></td>
<td>11</td>
<td>6</td>
<td>17</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year</th>
<th>No. of fatal accidents occurred to employers, self-employed persons or illegal workers</th>
<th>New works</th>
<th>RMAA</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td></td>
<td>1</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>2001</td>
<td></td>
<td>2</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>2002</td>
<td></td>
<td>0</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>2003</td>
<td></td>
<td>1</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>2004</td>
<td></td>
<td>0</td>
<td>4</td>
<td>4</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year</th>
<th>All fatal construction accidents</th>
<th>The Percentage of reported RMAA works fatal industrial accidents in the construction industry</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>33</td>
<td>41.4%</td>
</tr>
<tr>
<td>2001</td>
<td>31</td>
<td>14.3%</td>
</tr>
<tr>
<td>2002</td>
<td>29</td>
<td>41.7%</td>
</tr>
<tr>
<td>2003</td>
<td>29</td>
<td>32.0%</td>
</tr>
<tr>
<td>2004</td>
<td>21</td>
<td>35.3%</td>
</tr>
</tbody>
</table>

Table 11: Fatal Industrial Accident in RMAA Works, Labour Department
The Labour Department also conducted survey on different aspects on analyzing the Top two RMAA accidents.

The statistics includes the type of work being performed, the summary is shown in Table 12

<table>
<thead>
<tr>
<th>RMAA Accidents analyzed by</th>
<th>Top-2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Fatal Accidents</td>
</tr>
<tr>
<td>Type of work being performed</td>
<td>1. Demolition work</td>
</tr>
<tr>
<td></td>
<td>2. Electrical wiring</td>
</tr>
<tr>
<td>Body part injured</td>
<td>1. Multiple locations</td>
</tr>
<tr>
<td></td>
<td>2. Skull/scalp</td>
</tr>
<tr>
<td>Injury nature</td>
<td>1. Multiple injuries</td>
</tr>
<tr>
<td></td>
<td>2. Contusion &amp; bruise</td>
</tr>
<tr>
<td>Age Group</td>
<td>1. 30-34</td>
</tr>
<tr>
<td></td>
<td>2. 25-29 &amp; 45-49</td>
</tr>
<tr>
<td>Sex</td>
<td>1. Male</td>
</tr>
<tr>
<td></td>
<td>2. Female</td>
</tr>
</tbody>
</table>

4.3 Type of accident in RMAA

The top two killers in RMAA works are “fall of person from height” and “contact with electricity or electric discharge”. Fall of person, improper manual handling and poor housekeeping have accounted for a significant percentage of industrial accidents in RMAA works. (Table 13)

<table>
<thead>
<tr>
<th>Fatal Industrial Accidents Top-5 type of accident</th>
<th>No. of cases</th>
<th>%</th>
<th>Non-fatal Industrial Accidents Top-5 type of accident</th>
<th>No. of cases</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall of person from height</td>
<td>22</td>
<td>55.0%</td>
<td>Striking against or struck by moving object</td>
<td>2.402</td>
<td>22.2%</td>
</tr>
<tr>
<td>Contact with electricity or electric discharge</td>
<td>10</td>
<td>25.0%</td>
<td>Striking against fixed or stationary object</td>
<td>1.624</td>
<td>15.0%</td>
</tr>
<tr>
<td>Contact with moving machinery or object being machined</td>
<td>2</td>
<td>5.0%</td>
<td>Injured whilst lifting or carrying</td>
<td>1.458</td>
<td>13.5%</td>
</tr>
<tr>
<td>Trapped by collapsing or overturning object</td>
<td>2</td>
<td>5.0%</td>
<td>Slip, trip or fall on same level</td>
<td>1.370</td>
<td>12.7%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Fall of person from height</td>
<td>1.361</td>
<td>12.6%</td>
</tr>
</tbody>
</table>

Table 13 Industrial Accident in RMAA –analyzed by “Type of Accident” (2000 to 2004), Labour Department
4.3.1 Fall of person from height

Fall of person from height is the top killer in the construction industry. It contributes from 32% to 63% of the fatal accident toll between 2000 and 2004. The statistics also shows that the deceased person fell from bamboo scaffolds, working platforms/falseworks or unfenced dangerous places in nearly half of the fatal cases. (Table 14)

<table>
<thead>
<tr>
<th></th>
<th>2000</th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fatal accidents in the</td>
<td>29</td>
<td>28</td>
<td>24</td>
<td>25</td>
<td>17</td>
<td>123</td>
</tr>
<tr>
<td>construction industry</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>“fall of person from height”</td>
<td>13</td>
<td>9</td>
<td>15</td>
<td>9</td>
<td>8</td>
<td>54</td>
</tr>
<tr>
<td>fatal accidents in the</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>construction industry</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Percentage of “Fall of person</td>
<td>44.8</td>
<td>32.1</td>
<td>62.5</td>
<td>36.0</td>
<td>47.1</td>
<td>43.9</td>
</tr>
<tr>
<td>from height” to total (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>“fall of person from height”</td>
<td>2000</td>
<td>2001</td>
<td>2002</td>
<td>2003</td>
<td>2004</td>
<td>Total</td>
</tr>
<tr>
<td>accidents breakdown by</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>“place of fall”</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Bamboo scaffolds</strong></td>
<td>2</td>
<td>3</td>
<td>5</td>
<td>3</td>
<td>0</td>
<td>12</td>
</tr>
<tr>
<td>**Working platforms/</td>
<td>3</td>
<td>0</td>
<td>4</td>
<td>0</td>
<td>3</td>
<td>10</td>
</tr>
<tr>
<td>falseworks**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unfenced edges &amp; lifts shaft</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>openings</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fragile structures</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Ladders</td>
<td>2</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>Material hoistways</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>Unfenced/ insecurely covered</td>
<td>0</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>openings</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>others</td>
<td>2</td>
<td>1</td>
<td>4</td>
<td>4</td>
<td>1</td>
<td>12</td>
</tr>
</tbody>
</table>

Table 14. Fatal Industrial Accidents in the Construction Industry (2000 to 2004), Labour Department

“Fall of person from height” is also the top killer in the RMAA works. It contributes from 25% to 75% of the fatal accident toll of the sector between 2000 and 2004. The statistics
also shows that 45% (10 cases) deceased persons fell to death from bamboo scaffolds and unfenced edges. (Table 15)

<table>
<thead>
<tr>
<th>Place of fall</th>
<th>2000</th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bamboo scaffolds</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>Working platforms / falsework</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Unfenced edges &amp; lift shaft openings</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>Fragile structures</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>ladders</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Material hoistways</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Unfenced/ insecurely covered openings</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>others</td>
<td>1</td>
<td>0</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>Total</td>
<td>4</td>
<td>1</td>
<td>7</td>
<td>6</td>
<td>4</td>
<td>22</td>
</tr>
<tr>
<td>Fatal industrial accidents in RMAA works</td>
<td>12</td>
<td>4</td>
<td>10</td>
<td>8</td>
<td>6</td>
<td>40</td>
</tr>
<tr>
<td>Percentage of “fall of person” to total (%)</td>
<td>33.3</td>
<td>25.0</td>
<td>70.0</td>
<td>75.0</td>
<td>66.7</td>
<td>55.0</td>
</tr>
</tbody>
</table>

Table 15. “fall of person from height” fatal industrial accidents in RMAA works (2000 to 2004) –analyzed by “place of fall”, Labour Department

According to Lee (1996), experience has shown that the chance of having a fatal injury when falling through a distance of two meters is very high. When a worker has to work above two meters from the foot-hold surface, he is regarded as working at height.

4.3.2 Contact with electricity or electric discharge

Maintenance workers are likely electrocuted when carrying out repairing work. The cause of electrocution is mainly due to the poor insulation of electric wire and the unearthed
metal casing. Once leakage current flows from the accidentally energized metal casing of the electric applicants and then passed through the worker’s body to the earth, the workers will receive an electric shock. In addition, there are a few other reasons causing electrical hazard, for instance electrical installation and equipment are not properly inspected and regularly maintained; improper connection of electrical equipment.

4.4 Comparison between RMAA and the construction industry

Despite of the declining trend of the construction accident in the industry, industrial accidents in RMAA work is oppositely going on a upward trend. The table below can clearly show that the percentage of reported RMAA works accidents in the construction industry is increasing from 28.5% in 2000 to 37.9% in 2004. The percentage for fatal accidents of RMAA in the construction industry remain in a high level, i.e. falls between 35 % and 41%.

<table>
<thead>
<tr>
<th></th>
<th>2000</th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
</tr>
</thead>
<tbody>
<tr>
<td>All reported...</td>
<td>11925</td>
<td>9206</td>
<td>6239</td>
<td>4367</td>
<td>3833</td>
</tr>
<tr>
<td>All reported accidents in RMAA work</td>
<td>3402</td>
<td>2582</td>
<td>1925</td>
<td>1485</td>
<td>1454</td>
</tr>
<tr>
<td>Percentage of reported RMAA works accidents in the construction industry</td>
<td>28.5%</td>
<td>28.0%</td>
<td>30.9%</td>
<td>34.0%</td>
<td>37.9%</td>
</tr>
<tr>
<td>All reported...</td>
<td>29</td>
<td>28</td>
<td>24</td>
<td>25</td>
<td>17</td>
</tr>
<tr>
<td>All reported...</td>
<td>12</td>
<td>4</td>
<td>10</td>
<td>8</td>
<td>6</td>
</tr>
<tr>
<td>Percentage of reported RMAA works fatal accidents in the construction industry</td>
<td>41.1%</td>
<td>14.3%</td>
<td>41.7%</td>
<td>32.0%</td>
<td>35.3%</td>
</tr>
</tbody>
</table>

Table 16Number and percentage of construction accidents and fatal industrial accidents in RMAA works, Labour Department
4.5 Safety measures in RMAA works

The majority of RMAA works have been undertaken by small contractors, employing only a few workers and the work usually lasts for only a short period of time. Works of such a scale are not required to be reported to the Labour Department. As a result, many RMAA works would not come to the notice of Labour Department until serious accidents occur.

Stated in the speech of spokesman from the Labour Department in the Construction Association’s Annual Safety Conference 2005, special strategy has been adopted to monitor the RMAA works. In addition to routine inspections, occupational safety officer will carry out high mobile and flexible patrol operations to detect RMAA works. Officers not only set up point-to-point inspections on normal working days, but also at night and during holidays to clamp down on offending contractors.
The Labour Department also co-operate with the Hong Kong Association of Property Management Companies by setting up a reporting mechanism on high-risk property renovation and maintenance works. The Labour Department can get hold of schedules of property maintenance works using truss-out scaffold and to take follow-up action. Failure of truss-out scaffold is one of the major causes of person fall from height.
Chapter 5. Factors Affecting Safety Performance in Construction Industry and RMAA Works

The factors affecting the safety performance in the construction industry and RMAA works will be illustrated in this chapter. The factors are classified into aspects.

5.1 Safety Climate

5.1.1 Definition of safety climate

“Safety climate” is often mistaken for “safety culture”. Although they are inevitably linked, they are distinctly separate entities. Safety culture is much broader than safety climate. According to Cooper and Philips (1994), safety climate is concerned with the shared perceptions and beliefs that managers and workers hold regarding safety in the workplace. Safety climate is characterized by a collective commitment of care and concern, whereas all employees share similar positive perceptions about organization safety features.

Uttal’s (1983) defined safety culture as a shared values (what is important) and beliefs (how things work) that interact with an organization’s structures and control system to produce behavioral norms.(the way we do things around here).

Safety climate is dependent on the prevalent safety culture, in can be argued that safety climate is a product of safety culture and the two terms should not be treated as alternatives.

Schneider (1990) define climate as “incumbents” perceptions of the events, climate as it refers to the whole. On the other hand, safety climate refers solely to people’s perceptions of, and attitudes towards safety. A good safety climate is practices, and procedures and the kinds of behavior that get rewarded, supported, and expected in a setting.
Safety climate\(^{26}\) is often used to describe the tangible outputs of an organization health and safety culture as perceived by individual or groups at a particular point in time. Zohar (1980) have another definition of safety climate, he said safety climate is a term used to describe shared employee perceptions of how safety management is being operationalized in the workplace, at a particular moment in time.

The result of J. Constr’s paper corroborated the importance of the role of management commitment, communication, worker’s involvement, attitude, competence, as well as supportive and supervisory environment, in achieving a positive safety climate.

Cox and Cox (1991) argues that employee attitude are one of the most important indictors of safety climate, since these attitude are often framed as a result of all other contributory features of the working environment.

5.1.2 The effect of safety climate and culture on safety performance

Zohar (1980) developed a safety climate instrument which includes seven dimensions, for instance degree of management commitment to safety, effects of safe job performance on promotion, relative effectiveness of enforcement versus guidance in promoting safety, and this instrument was administrated in 20 factories in Israel. The instrument demonstrated that the higher the perceived safety climate of an organization, the higher it as been rated on its safety practices.

\(^{26}\) Survey of health and safety climate in Hong Kong hotel industry, Oct 1998, Occupational Safety and Health Council, HKSAR
The prevailing safety climate influences the outcome of all the organization’s safety improvement performance.\textsuperscript{27} There were studies indicating that safety climate measures the improvement of company’s safety culture accurately.

Reason (1998) stated that an ideal safety culture is the “engine” that drives the system towards the goal of sustaining the maximum resistance towards its operational hazards, regardless of the leadership’s personality or current commercial concerns.

5.1.3 Safety Climate determinants

Mohamed(2002) developed a research model based on the hypothesis that safe work behaviors are consequences of the existing safety climate, which in turn, is determined the identified independent constructs. These constructs includes management commitment, communication, safety rules and procedures, supportive and supervisory commitment, workers’ involvement, personal risk appreciation, work hazards appraisal, work pressure and competence.

Commitment

The commitment of management is a central element of safety climate (Zohar, 1980). Several studies show that the management’s commitment and involvement in safety is the factor of most importance for a satisfactory safety level. (Jaselskis, 1996). Langlord, Rowlinson and Sawacha (2000) found that where employees believe that the management cares about their personal safety, they are more willing to co-operate to improve safety performance.

\textsuperscript{27} Survey of health and safety climate in Hong Kong hotel industry, Oct 1998, Occupational Safety and Health Council, HKSAR
**Communication**

Various formal and informal means of communication should be adopted to promote and communicate the management’s commitment to safety. (Baxndale and Jones, 2000) Communication is one of the dimensions of psychological climate and it is believed that a good flow of communication of safety knowledge and policy within an organization will enhance workers’ awareness and behavior towards safety.

**Safety rules and procedures**

Rules and procedures are the core component of safety management systems. Cox and Cheyne (2000) stated that the extent which workers perceive safety rules and procedures as promoted and implemented by the organization is a major factor influencing safety level.

**Supportive and Supervisory commitment**

Supportive environment means the degree of trust and support within a group of workers, confidence that people have in working relationships with co-workers, and general morale. Having a supportive work environment demonstrates workers’ concern for safety and develops closer ties between them. (Goldberg, DarEL and Rubin, 1991) While managers develop and implement safety management programme, its actual success depends upon the ability of supervisory personnel to insure that the programme is carried out during daily operation. (Agrilla, 1999)

**Workers’ involvement**

Niskanen (1994) illustrated that only management participation and involvement in safety activities is not enough, but more important, the extent to which management encourages the involvement of the workforce. Workers’ involvement includes procedures for
reporting injuries and potentially hazardous situations.

**Personal appreciation of risk**

Cox and Cox (1991) argue that employee’s attitudes towards safety are one of the most important indices of safety climate. Attitude towards safety have been found to be associated with personal risk perception. (Rundom, 1997)

**Appraisal of physical work environment ad work hazards**

A research shows that tidy and well planned (layout) sites are more likely to provide a high level of safety performance. (Sawacha, Naoum and Fong, 1999). Workplace hazards were defined by Mohamed (2002) as tangible factors that may pose risk for possible injuries or ailments. With this definition, hazards do not always result in accidents, but waiting for the right combination of circumstances to come together.

**Work pressure**

Sawacha, Naoum and Fong (1999) found that productivity bonus pay could lead workers to achieve higher production through performing unsafely. Langford, Rowlinson and Sawacha (2000) stated that supervisors are likely to turn blind eye to unsafe practices on a site due to the pressure to achieve targets set by agreed programme.

**Competence**

Competence means the workforce’s perception of the general level if workers’ qualifications, knowledge and skills. Many researchers agree that training, especially in hazard-detection is a major factor influencing safety levels. (Simon, 1991; Jaselskis, 1996).
5.1.3 Safety Climate in Hong Kong

Safety awareness of workers in Hong Kong is very low. In the profit oriented city like Hong Kong, money and time is always come first. Safety will be forgone as the opportunity cost of quick and profitable outcome, especially in the case of RMAA works. You can easily find scaffoldings outside the building, but you can hardly find workers working on scaffolding with safety belts on them. Poor safety climate and culture are therefore creating high number of accidents in Hong Kong.
5.2 Nature of industry

5.2.1 Hectic schedule
Ahmed et al. (1999) identify the tight construction schedule as the most serious factor that adversely affects the implementation of construction site safety in Hong Kong. The schedule for RMAA work can be even shorter, ranged from 1 day to a few weeks. Safety is usually forgone for time and money.

5.2.2 High degree of subcontracting
Rowlinson (2004) defined subcontracting system as a system by which work is allocated to a main contractor that does not construct the works itself but employs subcontract organizations to produce the finished product. Typical subcontracting firms specialize in one area, for instance, concreting works, bricklaying, falsework and formwork erection and foundation construction. Many researches (e.g. Wong, 1999 and Lee, 1996) have indicated that the high accident rate of the Hong Kong construction industry was related to the multilayer subcontracting system. This structural problem poses management difficulties in terms of construction safety, productivity and quality management. Managing safety was a problem in term of communication and monitoring. In addition, many subcontractors are small firms which may not able to provide adequate training and education for workers.

5.2.3 Competitive tendering system
In the tendering process of a construction project, usually the lowest tender will get the job. The continued acceptance of the lowest tender which adds pressure on contractors’ margins results in cutting cost on safety issue. The situation is worsen under the multi layer subcontracting practice, the subcontractor at the bottom layers required to use an extremely limited price to finish the job, expense on safety is impracticable.
5.2.4 Daily work scheme

Construction industry is a highly labour intensive industry. Most of the workers are temporary work under daily work scheme. These workers are not directly employed by the main contractor but recruited by sub-contractors on a job-by-job basis. Construction works are usually daily paid. Workers stay on one particular site for a very short period of time, say a few weeks, then they will move to another new project site. Such employment practices have strong implications for construction safety. Sub-contractor is usually not willing or not able to provide training for the temporary site workers.

5.2.5 Size of company

Rowlinson (2003) revealed that the lack of barriers for entering the construction industry results in many small firms with insufficient resources and skills. In addition, these small may disappear in order to avoid legal responsibility.

Tam and Fung (1998) observed 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 demonstrated that larger firms generally have better safety records. This could be resulted from the more structured and formalized safety programme, and stronger management commitment to safety.

Wong and So (2004) also revealed that the higher number of employees in the organization, the lower figures of the accident rate.

5.2.6 Working environment

RMAA works are usually carried out in existing building, sometimes with poor condition. The working space is limited, usually tools and equipments can be placed properly.
Unlike new construction site, hoarding and proper working platform are not easily found in RMAA works. (Fig 7 & 8)

![Fig 7. Workers without proper working perform (Photo taken in Quarry Bay)](image)

![Fig 8. Construction site without proper sealing (Photo taken in Quarry Bay)](image)
These practices definitely increase the risk on the construction site and also pose danger to the public as shown in Fig 9. There is not enough storage space for construction materials and wastes, usually these material or waste will be use placed on the street.

Fig 9. Construction waste blocked the road (Photo taken in Sai Wan)
5.3 Human factors

5.3.1 Education and training level

Although the government has put great effort of education and training the work with safety related courses in co-operate with different parties, the effectiveness of these training facilities is quit limited due to a few reasons. (Rowlinson, 2003) The reasons are as follows:

♦ The number of people who benefit from the course is relatively small.
♦ Most construction workers learn their skills through on the job and relatively few learn about construction safety
♦ Low education level of workers results in workers may not assimilate safety messages spread by the Labour Department
♦ Tight working schedules lead to reluctance to release site foremen and workers to attend safety training courses.

5.3.2 Migrant workers

The site management may employ workers with different nationalities such as Pakistanis and Nepalese. The different languages may create a communication barrier. Rowlinson (2003) also pointed out that many of Hong Kong’s construction site workers have been immigrants from southern China. These imported workers need to work in a new environment and cannot obtain clear supervision by Cantonese-speaking staff, thus higher accident rate are be expected.
5.4 Legislation

According to the Chapter 59I Construction Sites (Safety) Regulations, construction works which will be completed in a period of less than 6 weeks from the commencement date or will employ not more than 10 workmen at any one time. The regulation also allows construction work with less than 30 workers not to employ a person trained in first aid. As such, most of the RMAA works would not come to the notice of the Labour Department because of their small scale and short duration.

5.4.1 Contractual factor

Kwok (2006) stated that quite often many of the RMAA works do not involve the signing of formal contracts. The concept of employer-employee (between the person awarding the RMAA work and the worker performing the work) and sub-contracting are rather loose or virtually non-exist. Much of the work agreement is done verbally on a negotiation basis. A matter of trust helps in building up the relationship that brings about the execution and finally the completion of RMAA works.
Part III

Research Methodology and Result Analysis
Chapter 6. Methodology

In this study both qualitative and quantitative research methods were used in order to have a comprehensive investigation on the factors affecting the accident rates of the RMAA. According to the guideline offered by the Buildings Department to all authorized persons, registered structural engineers and registered geotechnical, Labour Department has revised the methodology for the calculation of accidents rates for the construction industry to reflect the site safety performance. The revised methodology will include all the personnel employed by contractors engaged at construction sites including the managerial and supervisory staff and manual workers. The objectives of this methodology are as follow:

1. Examine the significance of the factors affecting construction safety

2. Analysis and compare the importance of the factors

3. Examine the major factor causing higher accident rate in RMAA than in major construction work
6.1 Qualitative and Quantitative research methods

Murray (1921) defined qualitative and quantitative research as the following: qualitative methods involve a researcher describing kinds of characteristics of people and events without comparing events in terms of measurements or amounts. Quantitative methods focus attention on measurements and amount of the characteristics displayed by the people and events that the researcher studies. There are some similar definitions of these two research methods:

“Qualitative research is multimethod in focus, involving an interpretive, naturalistic approach to its subject matter. This means that qualitative researchers study things in their natural setting, attempting to make sense of, or interpret phenomena in terms of the meanings people bring to them. Qualitative research involves the studied use and collection of a variety of empirical materials –case study, personal experience, introspective, interview etc. –that describe routine and problematic moments and meanings in people’s lives. “(Denzin & Lincoln, 1994)

“Quantitative research uses numbers and statistical methods. It tends to be based on numerical measurements of specific aspects of phenomena; it abstracts from particular instances to seek general description or to test causal hypotheses; it seeks measurements and analyses that are easily replicable by other researchers.” (King, Keohane & Verba, 1994)
In this research study both approach were used in order to complementing the shortcoming of each other.

**Shortcomings of Qualitative approach**

Qualitative approach collects and analyzes data based on personal and subjective judgment. In most of the cases, qualitative approach is to conduct personal interview with target object. However, the views of the interviewees can only be a subjective analysis.

**Shortcomings of Quantitative approach**

Quantitative approach is a more statistical method in collecting and analyzing data. It enables accurate statistical comparison between different sample sets. Using statistical test, the influence of each preset factors can be examined under preset constraint. Quantitative approach is more accountable and reliable than qualitative approach. However a very large sample is needed to significantly represent the opinion of the respondents.
6.2 Regression model

There are two types of regression models, namely linear regression and multiple regression.

Linear regression analysis is applicable to a wide range of subject matters. Linear regression is applied to examine the functional relationship between a dependent variable and an independent variable. The functional relationship can be most conveniently expressed as a mathematical equation. Regression analysis involves determining the regression line, which is the best straight line approximation of the relationship between the two variables, that is to find out the particular values of the slope and intercept. In the normal case, where the dependent variable is plotted along the vertical axis, distance is measured vertically as the difference between the observed points and lines.\(^28\)

In reality, there may be several factors affecting a variable. In the study, there are several factors affecting the construction safety of RMAA works. In order to examine the relationship of those factors and the safety performance and the significant of the effects of those factors, multiple regression is adopted in this study.

Multiple linear regression generalizes the simple linear regression model by allowing

many terms in a mean function rather than just one intercept and one slope.\textsuperscript{29} The concept of multiple regression analysis is identical to that of simple regression analysis except that two or more independent variables are used simultaneously to explain variations in the dependent variable. Incorporating more variables implies that more aspects are under the control of the model, which enables a more accurate estimate of the effect of each variable to the dependent variable.

A graphical presentation of these concepts is more difficult, since with two or more independent variables, three-dimensional drawings are required.

Dummy variable or dichotomous variable takes only two values, either 0 or 1. It is useful to incorporate qualitative features into models.

From the regression outputs, three values are of particular importance to evaluate whether the results are satisfactory and the correctness of the hypothesis in view of statistical evidence. They are the coefficient of multiple determination ($R^2$), the estimated partial regression coefficients and the t statistic value. The $R^2$ states the degree to which changes in the set of casual variables generate changes in the dependent variables. It therefore describes how well the suggested hypothesized relationship explains the facts. The regression coefficients will specify the individual effect of how movement in each

\textsuperscript{29} Sanford Weisberg (2005).\textit{Applied Linear Regression}, Minnesota: A John Wiley & Sons, Inc, Publication
independent variable induces movement in the dependent variable, while other constant. A negative sign will indicate inverse variation. However, whether the relationship is statistically significantly different from zero, we need to compare the absolute value of the t-statistic to the critical value which determined but the confidence level desired and degrees of freedom.

Linear regression provides a powerful method for analyzing a wide variety of situation, nevertheless, this technique relies on a set of assumptions that may or may not hold in different applications. Potential problems associated with regression are autocorrelation, multicollinearity and heteroscedasticity.

6.2.1 Ordinary Least Square

In the multiple regression model, if we can estimate a best fit regression equation to the sample values, then we can use probability theory results to make inferences about the corresponding regression equation for the population. In order to find out a best fit equation, the vertical distances between the data point and the regression plane, i.e. the random errors in the model, should be as small as possible. This error may be due, for example, to randomness in behavior of other factors. Since some random errors are positive and some are negative, in order to minimize the random error, squaring is used.
That results a sum of squared errors.\(^{30}\)

Because the square of the errors are minimized, the term least squares regression analysis is used. If the error was not squared, distance above the line would be canceled by distance below the line. Thus it would be possible to have several lines, all of which minimized the sum of the non-squared errors. It is argued that remoteness increase the error. One way to deal with this problem is to weigh larger errors more than small errors, so that in the process of minimizing it is more important to reduce the large error. Squaring the errors is one means of weighting them.

6.2.2 Beta coefficients\(^ {31} \)

Multiple regression equation does not allow the direct comparison of the relative importance or contribution of each independent variable in accounting for dependent variance. This is because the various independent variables have been measured in different units. In order to compare the variables directly and meaningfully the relative importance of all independent variables in explaining variance, beta coefficients are used. The standardized beta coefficients are all converted into same units of measurement and this is directly comparable to one another. The larger the absolute value of the beta

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coefficient, the more important the contribution of an independent variable is in explaining of variance.

6.2.3 The model

In this study, multiple regression model is adopted to examine the significance of factors affecting construction accident. Seven proxies are chosen in constructing the model. Firstly, the proxies are selected without barriers on the collection of data. This means the data should not be insider information. Secondly, the proxies are chosen according to the theories studied in the previous chapters. Each independent variable will be discussed in detail in the following part.
Using the seven proxies and a dependent variable, a multiple regression equation is constructed as follow:

\[ A = a_0 + a_1 S + a_2 M + a_3 I + a_4 E + a_5 Tr + a_6 R + a_7 T + \varepsilon \]

\( A \) = accident rate

\( S \) = average contract sum

\( M \) = comprehensiveness of safety management

\( I \) = safety investment

\( E \) = education

\( Tr \) = training

\( R \) = risk awareness

\( T \) = working hours
A, refers to the accident rate, is the variance concerned in this study. All other factors concerning are included in this model as the independent variables. All the independent variables are identified from the literature review and the previous chapter.

\( a_0 \) is the interception of the equation. \( a_1, a_2, a_3, a_4, a_5, a_6, \) and \( a_7 \) are the corresponding beta coefficient of the independent variables.

### 6.2.4 Independent Variables

**Average Contract Sum (S)**

The main focus of this study is RMAA which usually involves smaller contract sum than major construction work. Tam and Fung (1998) observed that the accident rate of small companies is highest, whereas that for the large firm is the lowest. This variable could show the correlation between accident rate and RMAA.

**Comprehensiveness of safety management (M)**

In July 1995, the Hong Kong government published a consultation paper on the view of industrial safety in Hong Kong. The review recommended a new strategy of deal with safety and health at work. This new strategy encourages self-regulation through the implementation of safety management system. In the consultation paper, 14 key process
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elements in a safety management system are identified as follows:

1. safety policy
2. safety organization
3. safety training programme
4. in-house safety rules
5. safety committee
6. hazardous conditions inspection programme
7. job hazard analysis
8. accident investigation system
9. safety promotion programme
10. process control programme (including permit to work system)
11. personal protection programme
12. health assurance programme
13. sub-contractor evaluation and control system
14. emergency situation plans

Furthermore, Rowlinson (2003) regards safety as an integral part of the management process of a construction project. In order to achieve safety working environment, safety management system is essential. In addition, management is one of the four “M” factors causing accident in Multiple Factors Theory. The Multiple Factors Theory regards management as safety rules, organizational structure policy and procedures.

Usually small contractors deal with RMAA works. These small contractors may not be willing to invest on comprehensive safety management system due to the lack of financial and technological support. Therefore there is a higher accident rate in RMAA work than in major construction work.

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**Safety investment (I)**

Tang and Lee (1997) have conducted research on the optimal safety investment for construction projects, studying 18 projects. The results revealed that the optimal safety investment should be about 1% of the contract sum, consisting of the employment of safety professionals, the use of personal protective equipment, loss of time by employees during accidents, damage to plant etc. RMAA works usually involve small sums of contract. Therefore, contractors may not be willing to invest in safety issues in RMAA work because it will reduce the return rate. The lower the safety investment, the higher the accident rate occurs.

**Education (E) and Training (T)**

Education and training level are human factors affecting the accident rate as mentioned in the Human Factor Theory. The theory points out that accidents are the result of human error, and improper training is one of the human errors. Besides, Bird and Loftus’ Domino theory also stated that lack of knowledge or skill is one of the personal factors creating the basic cause of accidents. Due to the short and rushed construction period and tight budget in RMAA works, some semi-skilled or not well-trained workers may involve in the construction.
Risk awareness (R)

Accident-proneness theory pointed out that the lower the risk awareness, the higher the rate of accident. Furthermore, Goals freedom alertness theory also stated that if the level of worker awareness increases, the level of quality and safety rate also arises. In case of RMAA, the risk awareness is usually lower than that in major construction due to the less complicated task.

Working hours per week (T)

The longer the working hour, that means the more exhausted the workers are, the higher the accident rate. Working hour is one of the human factors affecting the accident rate as mentioned in Adjustment-stress theory, unrealistic demands placed on workers creates stress. The theory states that negative factors in the workers’ environment, for instance the on-the-job stress, create diversions of attention and that the lack of attention can be very detrimental to safety. RMAA works usually need to be completed in a very short period of time and results longer working hours of workers, this often results overloading on workers. Overloading may create human error according to the Human Factor Theory.
6.3 Research Process

The procedures of the developing regression model for this study are as follows:

1. Formulating Hypothesis
2. developing measures
3. collecting data
4. analyzing results
5. drawing conclusion

The research process will be discussed on by on in the following part.

6.3.1 Formulating Hypothesis

Hypothesis is a statement describing how one or more variables are expected to be distributed or interrelated. Such hypothesis will be compared to the results obtained after the research is completed. Hypothesis will be examined by some testing. The hypothesis is referred to as the null hypothesis, denoted $H_0$ and is assumed to hold unless sufficient evidence is found to reject it. The null hypothesis will be rejected if the computed difference is greater than the test value. The null hypothesis will not be rejected if the difference is less than or equal to the test value.

Hypothesis is not used to predetermine the research outcome but to provide baseline
against which to compare actual results. Usually hypotheses are formulated on the basis of researchers’ understandings of or theories about the research topic.

The research objective of this study is to find out the factors causing higher accident rate in RMAA than in major construction work. In the previous chapters, many factors were revealed. There are two hypotheses to test whether the factors were the critical causation of construction accident in RMAA. They are as follows:

Hypothesis one: The less the company invests in safety aspect, the higher the accident rate.

Since the contract sum for the RMAA work is relatively small and the company may not be willing to spend a large proportion on safety in order to maximize profit.

Hypothesis two: The less the comprehensive the safety management system is, the higher the accident rate.

Small contractor lacks of financial and technological support to comply with a comprehensive safety management (including 14 elements as mentioned before). In RMAA works, safety management is always skipped, most of the contractor may only comply with one or two among the 14 elements. In some RMAA works, safety
management system may even absent.

### 6.3.2 Collecting Data

The aim of research is to draw conclusion and make generalizations about an entire population. Population is the entire collection of objects under consideration. Sometimes we may have a complete listing of the population, but most of the time a census is too expensive and time consuming to collect. Moreover, it is seldom necessary to consider an entire population in order to make some fairly strong statistical inferences. Therefore, collect and analyze data from a smaller, i.e. sampling is required. Sample is a subset of the population.

The sample of the population should be representative. Therefore, careful sampling is essential for constructing a meaningful study. Different ways to conduct survey research are used depending upon the types of research questions and hypothesis researchers have.

In this study, simple random sampling is adopted. In a simple random sampling, everyone or everything in the population has an equal and known probability of being selected for or included in the sample. A complete listing of all the elements in the population is essential for simple random sampling. Then a table of random numbers or a computerized
routine for randomly selecting numbers is used to draw the desired sample size.

The main problem of random sample is that the actual and complete listings of the population may not be available or accessible.

In this case, the target population is come from the list of approved contractors for public works which is issued by the Environment, Transport and Works Bureau.

There are two basic ways of collecting data from respondents, they are questionnaires; mass-administered or mailed and interview; face to face or telephone.

Mass-administered questionnaires are distributed to groups of respondents such as assembled members of organizations. Mailed questionnaires are usually mailed out to respondents’ office and are mailed back to researchers upon completion.

In this study, mass-administered questionnaires are adopted. This is because the response for mailed questionnaire may not be satisfied. On the other hand, time is a great constraint for interview, especially for the targeted small and medium sized contractors. Furthermore, a larger sample is required to draw a meaningful conclusion.

Both English and Chinese version would be provided to the respondents. Back translation method was adopted to ensure the consistency of meaning in the English and Chinese.
6.3.3 Questions in questionnaire

A. Background information

Q.1 Your position in the firm

This question ensures the respondents are experts on construction safety matters, such as safety officers, supervisors and construction workers.

Q.2 No. of reportable accident of the firm

In this question, the dependent variable i.e. the accident rate would be obtained.

B. Size of the company

Q.3 No of employees in the firm

This question helps to indicate the size of the company and the relationship between company size and RMAA work.

Q.4 No. of safety officers employed in the firm:

This variable is used as the independent variable of comprehensiveness of safety system.
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Q.5 Percentage of part-time worker in the company

Part-time worker usually are not well trained and not familiarize with construction site environment. This variable is used in the analyzing the risk awareness.

C. workers

Q.6 The average education level of the construction workers in the company

This question reveals the education level of workers and used as independent variable.

Q.7 The percentage of construction worker with Construction Industry Safety Certificate (Green Card)

Q.8 Do the workers receive special construction training?

This question reveals the level of training that workers received. This is used as independent variable.

Q.9 Average contractual time for completing a project:

This reveals the degrees of exhaust of worker, the shorter the completing time, the longer the working hours.

Q.10 Average working hours per week

This question reveals the degrees of exhaust of worker. This variable is used as independent variable.
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Q.11 Average value of contract

RMAA work usually involves a small amount of contract sum.

Q.12 Average number of years of plant used by the firm

The longer the plant used, the higher the attrition rate, this reveals the risk awareness of the company.

Q.13 Is there any safety management system in your company?

This question ensures the respondent answering Q.14 & 15 are those having safety management.

Q.14 How long has it set up the system?

This reveals the construction safety awareness of the company.

Q.15 Does your company’ safety management system consist of the following components:

The 14 elements are published in the consultation paper issued by the government. This question reveals the comprehensiveness of the safety management system adopted by the company.
Q.16 Average percentage of safety investment in and average contract

This question reveals the amount of money invest on safety issue. It is used as independent variable.

Q.17 When discovering dangers during work, you will:

Q.18 Is accident likely occurs when you doing construction work?

These two questions reveal the risk awareness of the construction personnel. It is used as the independent variable.

### 6.3.4 Analyzing results

Different techniques are used to analyze the result, depending on the types and number of variables being studied. Certain techniques are appropriate for describing and summarizing several variables, for example t-test.

Coefficient of multiple correlation ($R$) indicates the degree to which variation in the dependent variables is associated with variations in the several independent variables taken simultaneously. $R^2$ the coefficient of multiple determination, measures the percentage of the variation in the dependent variable which is explained by variations in the independent variables taken together.
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The value of the coefficient of determination will never decrease when other variable is added to the regression. Although the additional variable may be of no use whatsoever in explaining variations in the dependent variable, it cannot reduce the explanatory value of the previously included variables.

6.3.5 Drawing conclusion

The basic conclusion involves a discussion that addresses whether the evidence analyzed supports the hypothesis. The result should reveal the interrelationship between the variables. Replication of results increase confidence in explanation and enhance their general acceptance. Being able to communicate research results is a particularly valuable skill useful in the study.

6.4 Interview

Interview means a researcher orally ask question and the interviewee answer orally. Interviews traditionally have to been conducted face-to-face, i.e. the researcher speaking to one interviewee directly at a time.
6.4.1 Planning an interview

Different approach can be used when planning an interview. They are loose-question, tight-question, converging-question and response-guided.33

Loose-question approach

The purpose of loose-question approach is to induce respondents’ interpretation of general question. The interviewer should design question which allows interviewee unrestricted freedom to answer, therefore open-ended questions should be asked.

Tight-question approach

A tight strategy is designed to discover respondents’ preferences among a limited number of options. Thus, tight questions require interviewees to select from a restricted set of answers.

Converging-question approach

Converging approach integrated the advantage of both loose-question and tight-question methods. The interviewer first asks broad, open-ended questions to learn what is in respondents’ mind in related to the topic. Then, following the respondents’ reply, the interviewer asks one or more sharply pointed questions.

Response-guided approach

The interviewer begins with a prepared question, then spontaneously creates follow-up questions on the answer from the interviewee. This approach enables the researcher to investigate in detail the respondent’s opinion about issues related to the initial question.

6.4.2 Collecting data

In order to have a in depth investigation in the safety practice, safety performance and safety climate in Hong Kong construction industry, government bodies, related professionals and practitioners are the targets of this qualitative research.

In this study seven interviews were conducted with different parties, they are as follows:

- Mr Chan Sam Choi, Mixer Truck Driver Association
- Mr. Patrick W.T. Chan, The Hong Kong Construction Association
- Mr. Wu Suk Keung, Architectural Services Department
- Mr. Shing Wai Lam, Johnny, Society of Registered Safety Officers
- Mr. Joseph HC Chong, ISG Asia (Hong Kong) Limited
- Mr. Norbert C Y Fan, N C Fan China Consultants Ltd.
- Mr. Edmond S C Chan, Gammon Construction Limited

6.4.3 Questions in interview

In this study, both loose-question and Response-guided approach were used in order to obtain the opinion of the respondents without bias. Key questions are prepared for investigated the view point of interviewee on the subject topic. Following up questions were created according to the answer from the interviewee and the job nature of the interviewee. Some of the key questions are listed out below:

1. Please comment on the safety performance of construction industry in Hong Kong.
2. What are the main factors affecting the safety performance?
♦ Is high level subcontracting one of the factors?
♦ Is safety climate one of the factors?

3. Is the exiting safety practices applied sufficient?

4. Are the related regulations efficient and sufficient for improving the safety performance?

5. According to the Labour Department, the accident rate for some repair, maintenance, alteration and additional works (RMAA works) is getting higher and higher, what are the reasons behind?

6. Is there enough support for the small contractors in safety practice?

7. Any suggestion for improving the safety performance in the construction industry and RMAA works?

6.4.4 Analyzing qualitative data

Moore (2000) illustrated the practical procedure for analyzing qualitative data. Firstly, themes and issues should be identified. Identify the issues that set out to explore in the research and the themes that informed those issues. Then, refer back to the aim and objective of the study. The next step is imposing orders on the data collected. Finally look for explanations through the data, thus building tentative model and explanations of behavior.
Chapter 7 Questionnaire Result and Analysis

In this chapter, the data collected from the questionnaire will be analyzed and results will be generated. The results generated will be interpreted to see which factor(s) are more significant in affecting the safety performance on the construction industry statistically.

7.1 Questionnaire responded

The total number of registered general building contractors in Building Department is around 576. A sampling of 250 was randomly selected out of the 576 companies. Totally 250 questionnaires were sent out and 51 were responded. The response rate is 20.4%. Among the questionnaires responded, 2 of the questionnaires are found to be invalid because some of the questions are unanswered. Thus, there are total 49 questionnaires available for regression analysis.

Fig 10. Distribution of the responded questionnaires
7.2 Statistical analyses

In the regression model, totally 7 proxies will be investigated to study their influence on safety performance, they are I, E, Tr, R, S, M and T.

Backward elimination is adopted to find out the best-fit model. After using the method, best-fit model is found with no proxies removed.

There are seven proxies in the best-fit model with 0.76 adjusted $R^2$ value. This means that variation in the seven explanatory proxies is able to explain about 76% of variation of the dependent variable. Thus, there are some other unknown factors affecting the safety performance in construction industry.

According to Table 17, four proxies are found to be significant at 0.1% significance level or below, they are I, Tr, M and T; whereas the other three (E, R and S) are insignificant at all (significance level > 0.1).
Table 17 - Multiple Regression Model Results

7.2.1 Safety Investment (I)

I is found to be the most significant factor (more than 99% confidence level) with regression coefficient -0.15. This implies that one more element added in safety investment will result to a 0.15% reduction in accident rate. The statistical results is coincident with the hypothesis, the more the company invest in safety, the less the accident rate.
7.2.2 Education (E)
According to Table 7.1, E has a regression coefficient -0.02 at 0.72 significant level (the least significant factor). This is coincident with hypothesis that more education received by the workers, the lower the accident rate. However, E is regarded as an insignificant factor.

7.2.3 Training (Tr)
According to Table 7.1, it is 91% confident to conclude that Tr is negatively related to A, as suggested by the hypothesis. When workers received sufficient training, the accident rate can be reduced by 0.07 units.

7.2.4 Risk awareness (R)
R is considered as insignificant although it negatively related to A, which is coincident to the hypothesis. Such insignificant level may be due to the difficulties in testing one’s awareness. Risk awareness involves many aspects such as understanding of hazard.

7.2.5 Contract Sum (S)
S is regarded as insignificant and it is positively correlated with A, which contradicts to hypothesis. Such contradiction may be due to the fact that contract sum may not reflect the proportion the contractor is willing and able to spend on safety measures. As mentioned in pervious chapters, the tender competition is keen. This result that not part of the contract sum can be spent on safety. These components may not be analyzed by quantitative methods.
7.2.6 Comprehensive of safety management (M)

M has a regression coefficient of -0.02 at 5% significant level. The negative correlation of M to A is coincident with hypothesis. It suggested that the one more element added in the company safety management system leads to 0.02 units of accident rate reduction. The more comprehensive a safety management system is, the lower accident rate is.

7.2.7 Working Hours (T)

T has the least correlation with A (0.007) at 5% significant level. This means that we are 95% confident that one work longer hours leads to 0.007 unite more accident rate. This is coincident with hypothesis. According to the accident proneness theory mentioned in previous chapters, at certain times people are more liable to have an accident, for instance under stress. Stress can be in term of overload, which is work for long hours.
7.2.8 Importance of proxies

The importance of the seven proxies in the model are ranked in terms of confidence level and regression coefficients as in Table 7.2

<table>
<thead>
<tr>
<th>Rank of importance</th>
<th>Proxies</th>
<th>Regression coefficient</th>
<th>Confidence level (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>The most important</td>
<td>I</td>
<td>-0.15</td>
<td>99.91</td>
</tr>
<tr>
<td></td>
<td>M</td>
<td>-0.02</td>
<td>95</td>
</tr>
<tr>
<td></td>
<td>T</td>
<td>0.007</td>
<td>95</td>
</tr>
<tr>
<td></td>
<td>Tr</td>
<td>-0.07</td>
<td>91.35</td>
</tr>
<tr>
<td>The least important</td>
<td>R</td>
<td>-0.09</td>
<td>82.8</td>
</tr>
<tr>
<td></td>
<td>S</td>
<td>0.00000000034</td>
<td>28.7</td>
</tr>
<tr>
<td></td>
<td>E</td>
<td>-0.02</td>
<td>27.34</td>
</tr>
</tbody>
</table>

Table 18 - Rank of Importance of the Proxies in Regression Model

7.3 Test on Hypothesis

The regression model aims to find out the factors causing high accident rate in construction industry and RMAA works. Two hypotheses have been set up in previous chapter as follows:

Hypothesis one: The less the company invests in safety aspect, the higher the accident rate.

Hypothesis two: The less the comprehensive the safety management system is, the higher the accident rate.

Hypothesis one statically stands. Proxies I represents safety investment in a construction
project. The regression coefficient of proxy I is -0.15 which shows a negative relationship between the dependent variable and independent variable. This negative correlation concurs with hypothesis one, the less the company invests in safety aspect, the higher the accident rate. In addition, the result from the regression model also proof that safety investment is the most significant factor affecting construction accidents, it ranks the top in confidence level. Tang and Lee (1997) examine that the optimal safety investment in construction project in Hong Kong is round 1% of contract sum, whereas the minimum safety investment should be around 0.6%. However, the result in the questionnaire shows that most of the small contractors invest less than 0.6% in safety measures.

Hypothesis two also statically stands. Negative correlation between the independent variable and dependent variable is shown in the value regression coefficient of proxy M, i.e. -0.02. That means the result supports the hypothesis that the less comprehensive the safety management system is, the higher the accident rate. Proxy M also ranks the second highest in confidence level, that’s means M is a significant factor affecting accidents rate. From the result of the questionnaire, most of the small contractor involving in RMAA works only comply with one or two of the 14 elements of safety management system, for instance only providing safety policy but nothing else like accident investigation system or emergency situation plans.
Chapter 8. Interview Results and Analysis

8.1 Introduction

In previous chapter the factors affecting safety performance in Hong Kong construction industry is illustrated. The correlation between those factors and accident rate was analyzed in an statistical way. Nevertheless, seven interviews were conducted in order to examine safety practice, safety performance and safety climate in different prospective.

<table>
<thead>
<tr>
<th>Interviewee</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mr Chan Sam Choi</td>
<td>Concrete Industry Workers Union Secretaty General</td>
</tr>
<tr>
<td>Mr. Patrick W.T. Chan</td>
<td>The Hong Kong Construction Association Secretary General</td>
</tr>
<tr>
<td>MR. Wu Suk Keung</td>
<td>Architectural Services Department Property Service, Contracts management &amp; Site Safety group</td>
</tr>
<tr>
<td>Mr. Shing Wai Lam, Johnny</td>
<td>Society of Registered Safety Officers Vice-president</td>
</tr>
<tr>
<td>Mr. Joseph HC Chong</td>
<td>ISG Asia (Hong Kong) Limited Chartered Quantity Surveyor</td>
</tr>
<tr>
<td>Mr. Norbert C Y Fan</td>
<td>N C Fan China Consultants Ltd. Sub committee of Society Register Safety Officers</td>
</tr>
<tr>
<td>Mr. Edmond S C Chan</td>
<td>Technical services manager (Health, Safety &amp; environment) Gammon construction limited</td>
</tr>
</tbody>
</table>
8.2 Summary of Interviews

8.2.1 Interview with Mr. Chan Sam Choi –Concrete Industry Workers Union

Mr. Chan is the representative of Concrete Industry Workers Union which is affiliated to the Hong Kong Confederation of Trade Unions.

Mr. Chan, representing the voice from worker, commented that there are insurance scheme is not effective in protecting the safety of workers. Contractor company only required to buy labour insurance for its employees. In order to minimize the cost on insurance, some company will force workers to be entitled as self employed. Therefore, these workers cannot enjoy the protection of the insurance scheme.

In addition, Mr. Chan also pointed out that these workers are usually poorly educated and trained, many of them even without any certification e.g. green card or silver card.

Mr. Chan pointed out that high level of subcontracting is one of the big reasons explaining the poor safety performance in Hong Kong construction industry. He illustrated the situation with a real case. A client wanted to do some repair and maintenance work for his home, including repair the aluminum window frame. A worker fell of height when he was removing the scaffolding, and died. The client employed a maintenance company, the company subcontract the project to B company to repair the window, B company subcontract to C company to dismantle scaffolding. The worker is employed by company C and entitled as self employed. The family of the deceased worker sues the client. Responsibility cannot be well determined, and some sub contractor may close down and escape from legal responsibility.

In regard of the protection of workers, Mr. Chan mentioned that the industry has urged the government to develop a fund for central accident claim.
8.2.2 Interview with Mr. Patrick W.T. Chan- The Hong Kong Construction Association

Mr. Patrick Chan is the Secretary General of The Hong Kong Construction Association. He is a professional civil engineer with more than 20 years experience in the industry. Mr. P. Chan commented that although the accident rate in Hong Kong construction industry is keep dropping, the accident rate is still very high. In the past, the accident is unacceptable, which is more than 300/1000 workers. In 2006, the accident rate drops to 59/1000 workers. Nevertheless, when comparing with other developed countries, the accident rate in Hong Kong is still very high.

However, Mr. P. Chan also pointed out that numbers may not reflect the real situation. The definitions of accident rate in different countries are different. Some foreign countries only take into account the local workers not immigrated workers. In Hong Kong, the coverage of the definition is quite wide.

When being asked about the increasing accident rate in RMAA works, Mr. P. Chan revealed that there was no actual figure for number of accident in RMAA works in the past. So it is difficult to say whether there is an increasing trend. Mr. P. Chan also pointed out that accident is usually analysis by activities, e.g. fall from height. However, the working environment may be different for each case. For instance, two cases of fall from height, one occurs when installing windows in new construction work, another one occurs when installing windows in existing building.

The working environments are very different. In new work, the safety management and safety facilities e.g. scaffolding are better. However, in RMAA safety management and facilities is insufficient.

Mr. P. Chan stated that there are multiple factors affecting the occurrence of accidents, it
can be illustrated by a complicated equation:

\[
\text{Accident} = \text{Property owners} + \text{Main Contractor} + \text{Sub contractor} + \text{workers} + \text{tender price} + \text{awareness of safety} + \text{cost} + \text{safety management}
\]

Mr. P. Chan commented on the safety culture in Hong Kong is poor. In Hong Kong, the only thing in people’s mind is money. Safety is forgone for higher profit and short construction period. Most of the contractors are not willing to invest on safety management and safety measure, which increase private cost. However once construction accident occur, social cost then incurs.

Mr. P. Chan suggested in order to improve the safety culture in Hong Kong, the government should not only focus on the main contractor and workers, but also educated the general public with the value of safety.

### 8.2.3 Interview with Mr. Wu Suk Keung- Architecture Services Department

Mr. Wu is the head of the Contracts Management & Site Safety group in Architectural Services Department (ASD). ASD is mainly responsible for the government buildings, both new works and maintenance work.

According to Mr. Wu, once they receive an accident report, they will review on the accident. They will also coordinate with CITA, OSHC to hold some safety seminar and training programme for contractor. Some internal safety training will also be provided for the internal staff.

Mr. Wu believed that the existing safety regulation in Hong Kong is sufficient. Environmental, Transport and Works Bureau has provided sufficient guideline for safety.
and accidents definition. ETWB also established a standard accident rate for the industry to reach, that is 0.75/100,000 man hour. ASD works very strictly to achieve the standard. In the contract of ASD work, all safety requirements are clearly stated. All workers involved in ASD work required to show the qualified certificate.

When asking about whether the competitive tender price causes the poor safety performance in construction industry, Mr. Wu revealed that contractor who accept the low tender price should bear the risk.

Further more, Mr. Wu pointed out though there is less new construction work, all existing building need repair and maintenance, that is the reason for a high demand for RMAA work. Due to the economic downturn, there is less new construction project, some large contractors may also tender for small job, and therefore the competition for tender is keen.

8.2.4 Interview with Mr. Shing Wai Lam- Society of Registered Safety Officers

Mr. Shing is the Vice-president (2006-2008) of the Society of Registered Safety Officers (SRSO). SRSO aims to improve the safety performance in the industry by conducting seminar and training programme. It will also give comment on legislation council when government constructing regulation related to safety.

Mr. Shing revealed that Safety officer is responsible for implementing safety system and setting safety policy. However the role of safety officer is not clear nowadays. Safety Officer should only act as a advisory role at strategic level, the one who really implementing is the front line management and front line workers. In the industry, most of the front line management cannot realize this point and leave all the safety related
Mr. Shing believed that high level of sub contracting system is the main cause of poor safety performance in Hong Kong. The tendering competition is too keen, sub-contractor simply do not have money to spend on any safety measurement. Especially in case of RMAA works, most of the workers are unskilled and without safety knowledge, they cannot realize the risk in their work.

Notification of commencing of work is not necessary for most of the RMAA work and these works may be carried out at night, the safety performance is poor due to the lack of monitoring and inspection.

When asking about the sufficiency and effectiveness of government policy on safety, Mr. Shing stated that safety is taking about reasonable and applicable. The government is not doing very well in promoting safety in the industry. For instance, both Buildings Department and Labour Department have launched Code of practice for scaffolding. However the two CoP have different standard, there is a lack of communication among the government departments. Practitioner feels difficult to follow.

Further more, Mr. Shing pointed out that the safety climate in Hong Kong is poor. The safety climate and safety system in Japan are very mature. Japan has “5S” system while that is not common in Hong Kong. Even in Mainland China, some safety performance is better than that in Hong Kong. It is because workers are afraid of losing their job, they will follow the in-house safety rule straightly.

Mr. Shing suggested that to have an independent safety organization dealing with safety issue. The existing safety auditing system should be modify, all safety audit should be
randomly assign by government and increase the accountability and transparency of safety auditing.

Better construction design management is another way out, good design planning for maintenance and reduces the difficulties and danger faced during maintenance.

Finally, Mr. Shing suggested better education can help improving safety performance in Hong Kong in long term. For instance, safety concept should be included in secondary syllabus.

8.2.5 Interview with Mr. Joseph H.C. Chong – Chartered Quantity Surveyor

Mr. Chong is a Chartered Quantity Surveyor with several years working experiences in a leading contractor in Hong Kong.

Mr. Chong revealed that the safety performance in Hong Kong is improved in recent years. However the situation is better in large construction work than that in the RMAA works. This is due to the limited resource and time for RMAA works.

Mr. Chong reviewed that Gammon Construction is putting continuous effort on safety management, nevertheless, there were still a few fatal accidents occurred last year. After reviewing the accidents, Gammon Construction recently initiated a brand new safety training and registration centre which providing in-housing training for all its workers. They are the primer of this practice in the industry. Gammon Construction will simulate the real working situation for the workers have a practical understanding of the use of safety practice and equipments.
Mr. Chong also mentioned that as a leading contractor, Gammon Construction adopts regular safe working cycle, safety meeting, regular site inspection, safety site work and different awards. Awards are offered to arouse the safety awareness of workers, while the project manager will be punished for any serious accident occurs in the project. In-house health and safety handbook will be delivered to all workers.

Gammon Construction involved in a number of A &A works, for instance Mandarin Oriental hotel and Land Mark renovation. Gammon engaged safety consultant to keep track with the safety performance in these works.

Mr. Chong believed that limited time, resource and space are the main reason for the high accident rate in RMAA works. In RMAA works, the working space is very crowded and risk for hazard is high. Most of the worker may be poorly educated and have low safety awareness regarding to their job.

On the contractual aspect, Mr. Chong revealed that government is adopting pay-for-safety scheme. And for government project, contractor will be scored on both performance and tender price. If the number of accident exceeds a certain amount, the contractor will loses the chance to submit tender.

In the standard form of contract and standard for of contract for minor work issued by HKIS, neither one contains safety clause.

Mr. Chong pointed out that the existing regulation is sufficient, however not many people follows. He said that educating and motivating the frontline management is the key for improving safety performance in Hong Kong. In addition, using more prefabricating units
in construction works can reduce the accidents rate.

8.2.6 Interview with Mr. Norbert C Y Fan - Sub committee of Society Register Safety Officers

Mr. Norbert Fan is a registered safety officer and the managing director of a consultant firm in safety management.

Mr. Fan reviewed that the safety performance in Hong Kong is better in that in the past. Construction can be divided into 3 parts: civil work, foundation work and building work. The safety performance in civil work is the best among the three, while building work is the worst.

He further classified that the front stage construction perform better in safety aspect than the back stage construction work. This is due the increase of trade of work in the latter stage which makes management more difficult.

Mr. Fan concluded three main reasons for the poor safety performance in construction, they are as follows:

1. High level of sub-contracting
2. Low tender price
3. Daily work scheme

High level of sub-contracting results in difficulties in safety monitoring and unskilled workers. The low tender price in addition to the multi layer of sub-contracting causing limited resource for safety measures for small sub-contractor. The small sub-contractor not even has enough money to finish the job, so safety must be forgone.

Workers are hired on daily basis, it is difficult for the frontline management to manage the workers and their safety performance.
Mr. Fan also pointed out that the safety climate is heavily affected by the economy. During the economy upturn, people are willing to spend more on safety, while the opposite during economic downturn.

Mr. Fan suggested that clear safety requirement shall be clearly state in the contract, e.g. “follow the regulation whichever with higher requirement.” This provides clear guideline for workers and foreman to follow and reduce disputes. He also suggest Labour Department may it inspection power to police force in order to increase the inspection of unsafe work, e.g. for RMAA works. Since RMAA works may not notify the Labour Department and Buildings Department which result in lack of inspection. Further more Mr. Fan revealed that safety issue should be involved in 3 stages; they are design, manufacture and installation in order to improve the safety performance.

At last but not least, Mr. Fan emphasized that safety management is a kind of human management. Safety culture should be improved by education and promotion by the government. Government and some large firm should take an active role to motivate subordinates.

8.2.7 Interview with Mr. Edmond S C Chan – Technical Services Manager Gammon Construction Limited

Mr. Edmond Chan is the Technical Services Manager (Health, Safety & Environment) in Gammon Construction Limited.

Mr. Edmond Chan commented that in general public’s mind, the first impression of construction is dangerous and dirty.

In addition, the young generation is reluctant to join the construction sector, most of them will go to the service sector. Most of the workers stayed in construction industry are
mid-age or old workers with low education level. New comers for the industry are usually migrant worker who know little about the industry in Hong Kong. Due to this worker mix, the risk in construction site is higher than in other industries.

Mr. Edmond Chan also pointed out that the tender competition is keen and the construction period is short. These are the main reasons for the high accident rate in Hong Kong. Further more, workers do not have enough rest and results as construction accidents.

When asking about the ways to improve construction safety performance in Hong Kong, Mr. Chan pointed out that the most effective way is education for management in different levels. Life is worth more than every thing. That should be the responsibility for employer to provide a safe environment for workers. Top management commitment is very important for good safety performance.

Mr. Edmond Chan revealed that Gammon is the first company which establishes its own training centre in Hong Kong. The centre started its operation since 2003. Gammon believes that worker should have better training and safe education in order to reduce construction accident. It offers free training for all workers of contractor and sub-contractors who works in their construction site. Since 2003, there are more than 40000 workers have attained the training, which is one forth of the construction work force in the industry.

Mr. Chan commented that the green card issuing system is lenient; the quality of the workers cannot be ensured.
Mr. Chan also mentioned that Gammon construction limited has co-operate with the Tsinghua University and OSH to conduct a research on construction safety, more than 5000 practitioners are polled. The research revealed that workers demand for more practical training on construction safety.

Due to the above reasons, Gammon established their own training centre providing practical training for workers.

Mr. Chan stated that Gammon will treat sub-contractor as their business partner not subsidiary. All in-house safety standards will be clearly stated in the tender contract.
8.3 Conclusion

Concluding all the opinion from different interviewees, I sum up in four aspects, they are safety performance in Hong Kong, critical factors affecting safety performance, effectiveness of safety measures and suggestion for improvement.

8.3.1 Safety Performance in Hong Kong

Nearly all interviewees agreed than the safety performance in Hong Kong construction industry was improved when comparing with the past figures. This concurs with the figures shown in literature review. However, there is still large room for improvement.

8.3.2 Critical factors affecting safety performance

Some critical factors are concluded after collection the opinion of all the interviewees. The lowest tender price system results in keen competition, contractor do not have resource to spend on safety.

High level of subcontracting results in insufficient training and education for workers and causes difficulties in safety monitoring and inspection.

Short construction period for RMAA works causing difficulties in monitoring. Further more safety is usually forgone for quick completion.

Safety culture is not mature in contractor level, workers level and general public level.

The above opinions collected from interviews are used as supplement of the questionnaire result, since these four factors are difficult to quantify in questionnaire.

8.3.3 Effectiveness of safety regulations

Some interviewees expressed that some of the safety regulation and guideline is confusing. Practitioner may feel difficult in complying. However some interviewees stated that the safety regulation in Hong Kong is sufficient. Nevertheless, the key reason
for the ineffectiveness of the regulation is difficult to implement. Workers may simply ignore the regulations.

8.3.4 Suggestion for improvement

Nearly all interviewee regarded education and promotion as the most effective way to improve the safety performance in construction industry. This complies with the Bird & Loftus’ Domino Theory. Furthermore, safety culture is urged to be improved. Most of the interviewees pointed out that positive safety culture should be promoted in Hong Kong, as safety culture works as an engine that drives the system towards good safety performance. (Reason, 1998) Safety culture can be improved through education and promotion to both employers and employees. Some of the interviewee suggested heavy punishment should be used to motivate the contractor and frontline management; while some other interviewees suggested safety issue should be involved during design stage. Better construction design management would help in preventing accident.
Part IV
Epilogue
Chapter 9. Epilogue
This research study aims to realize the significant causes of accident in construction industry and RMAA works. All objectives of this study are achieved and will be discussed in the following part in detail. A conclusive summary of the research study is given in this chapter. Recommendation for improving the safety performance is also revealed in this chapter. Last of all, the limitation of the research study will be described.

9.1 Conclusion
Hong Kong is one of the most advanced cities in the world, however the accident rate in construction industry is highly unacceptable. Furthermore, there is a growing concern on accidents occurred for RMAA works in recent years. Current safety performance of construction industry and RMAA works is reviewed in Chapter 3 and Chapter 4. Although the government had put a great effort in reducing the accident rate in construction industry to around 50 accidents per 1000 workers, the accidents rate is still high when comparing with other advance countries. Furthermore, report of the Labour Department revealed that accident rate of RMAA works is in an up raising trend and contributed over 30% of the total accident in the industry.

Safety practice in construction industry is also examined. Safety Charter, Pay for Safety Scheme, Independent Safety Auditing Scheme, OHSAS 18001 and Safety Working Cycle are the safety management system commonly adopted in the construction industry. However, these safety measures are not commonly used in RMAA works due to the limited contract sum and tight schedule.

After evaluating the safety performance and practice, possible causes of accident are discussed in literature review. Seven proxies are drawn from the literature review for the multiple regression model, in order to investigate the significance of these factors. Among the factors affecting safety, safety climate is discussed in deep detail. Many studies
(Cooper and Philip, 1994; Schneider, 1990 etc.) found that positive safety climate can increase the alertness of accident in workplace.

It is observed that the safety problem in Hong Kong construction industry is complicated from the finding of questionnaires and interviews. The major attributes to the safety performance are summarized as follows:

9.1.1 Nature of the industry

The construction industry operates in the basis of competitive tendering. During the recession, when competition is strong, there is a temptation work with lower cost and unsafe practice. In Hong Kong, penalty clauses are usually found in contract for late completion. Tight schedules and overtime work impose stress for workers, safety is usually sacrificed.

In additional, the turnover rate of construction worker in single construction project is higher than other industries. (Lee, 1996). Workers are usually employed on daily basis; this makes training and safety management difficult and hard to conduct. These workers may not familiar with the new working condition, this also rise additional risk in construction work.

Multi-layer sub-contracting is a very common feature of the industry. The main contractor may not have direct knowledge of workers being employed by the sub-contractors. In the absence of sound management of sub-contractors on site, accident is the result of the lack communication and motivation.

9.1.2 Safety Climate

Mohamed (2002) revealed that a significant relationship between safety climate and safe work behaviour. Positive safety climate is the results from management’s commitment and non-punitive approach to safety, and promoting a more open, free-flowing exchange
about safety-related issues. However the safety climate is not well prevailing in Hong Kong.

### 9.1.3 Characteristics of RMAA

Supervision and enforcement on health and safety matters for RMAA works are not always possible. As RMAA works are small scale and of short duration (employing not more than ten workmen or period of work less than six months), there is no needed for notification of commencement of works to the Commissioner for Labour under the Construction Site (Safety) Regulations. The Labour Department statistics on RMAA works can only allow for revealing part of the accident scene.

RMAA works usually involve small contract sum, appropriate use of health and safety measures will not be thoroughly considered during work. With the implementation of mandatory provident fund scheme (MPF), many of the RMAA workers are treated as self-employed in order to avoid employer’s investment on the MPF. Being such self-employed workers, there is less likely for them to take health and safety at work into account seriously. For many workers, in order to maximize their return, these workers will minimize the investment in RMAA work.

In additional, RMAA works are commonly performed after normal working hours or only in weekends or holidays as workers engaged in the work have heir own full time commitment. This makes inspection and monitoring difficult. The training for workers is limited.

Many of the RMAA works do not involve formal contracts. Workers in a working group engaged in the works are close relatives or friends. They tend to behave in a similar manner. If the head workers of the group have little awareness on health and safety, other workers in the group will behave similarly in an unhealthy and unsafe manner.
Substandard equipment, for example, wooden electric welding machine, is still occasionally found in RMAA worksites. The use of non-waterproof electric cables, plugs, extension plug and sockets are common. Some of the RMAA workers do not even know that the tools they are using are substandard as they have little or no access to trade information or health and safety information.

In considering the work environment, there is usually limited space available for RMAA works, especially for small RMAA projects. Some of the works have to be carried out within the residential or commercial buildings. Corridors are used for storing or piling materials and equipment. The backstreets are sometimes occupied for work purpose. Poor housekeeping leading to health and safety problems like tripping, slip and fall are common.

9.2 Recommendation

Based on the findings in this study, the major factors causing the poor safety performance on constructions sites have been investigated. Measures to resolve the situation is discussed as follows:

9.2.1 The Government

It was found that the legislative control is confusing for subcontractors to comply with. The government should strengthen the legislative control on all parties involved in the industry and safety issue. Communication between different government parties should be improved and regulations and code of practice issued by different departments should be consistent.

If legislation can be made specific for enforcing sub-contractor, the attitude of
sub-contractor may be changed.

The government is also urged to launch the Mandatory Registration of Sub-contractors and minor work workers. Registration system is the most effective means to ensure the quality of workers. The professional knowledge of the workers can be recognized, this provides a benchmark for clients to engaged proper trained workers.

9.2.2 The Clients

According to Mr. Norbert Fan, clients also play a role in improving construction safety. Clients should consider society cost and strive for balance between time and safety. The clients as the finical support of main contractor (and sub-contractors), should put stronger emphasis on construction safety. Safety clauses should be included in contract. Safety performance should be included in the process of selecting contractors for every project. Balance scorecard can be one of the methods to indicate the contractor with good safety track records.

Developers are also suggested to set up voluntary registration of contractors and worker scheme, some of the large developers in Hong Kong like Swire Properties has adopted the scheme. This scheme can force the contractors to fulfill prescribed safety training and requirement.

Pay for safety scheme should be also applied in private construction project. The main constraint for the contractor to invest on safety is tight tender price. Pay for safety scheme is operated successfully in government project. Private clients should also adopt the same practice in order to reduce the social cost of accidents.
9.2.3 The Contractors

According to the research of Zohar (1980) the higher the perceived safety climate of an organization, the better its safety practices. Zohar also pointed out that commitment of management is a central element of safety climate. Therefore contractor should take an active role in promoting and creating safety climate within the organization. This can be done through rewarding and punishment. Safety measurement should be strictly implemented by the top management and front line management. Leadership and communication are the two key factors to motivate the subordinates (i.e. the workers).

According to the registered safety officer Mr. Fan, construction design management CDM may be a good way out for the current situation. Safety issue should be taken into account in design, manufacture and installation stages, especially for RMAA works. Some of the skyscraper in Hong Kong is not well design for maintenance and repair, for instance in case of repairing window or curtain wall. Hooks for gondola are rarely found in such skyscrapers.

“5 S” system can be imported from Japan to the construction field in Hong Kong. Yang, et al (2002) commented that 5S system can become one of the most effective means to resolve the problem of site safety.

“5S” system is a serious of management activities, including tidy (seiri), place (seitou), clean (seiso) , clear (seiketsu) and attain (shitsuke). The five items begin in “S” in Japanese, therefore call “5S” system. “5S” system aims to create a clean, comfortable, suitable and tidy environment for the employees. The achievement of “5S” is significant in preventing accidents. Clean and tidy site raise the qualification which make the flow
orderly, therefore faults can be discovered easily and efficiency improved. Further more, the work place can be increased and used effectively. “5S” system can effectively improve safety performance in case of RMAA case. Since the working environment is usually very crowded and limited, “5S” can definitely improve the working environment in RMAA work therefore decrease the risk for accident

9.2.4 The workers

Workers should be encouraged to receive more training and refresher course to enhance their skill and safety knowledge. The government should provide more financial support for the SME contractors, then subsidies can be provided for the workers. The existing subsidies from the OSHC are not sufficient and the benefit does not have wide coverage.

As workers are the major victims in case of accidents, they should be more self-disciplined and self-regulated. Construction Workers Registration Authority established under the Construction Workers Registration Ordinance and it started to register local, construction workers on Dec 2005. The objective on the registration is to ensure the quality of construction works through assessment of skills levels of workers by an objective registration mechanism. However, the registration progress cannot be completes satisfactorily, and the deadline for registration deferred. This shows that the workers are not self-disciplined.

Besides registration mechanism, education on risk in working environment can help workers to perform good safety practice in despite of the traditional unsafe practice and peer influence.
It is suggested the different trade unions should be united and reflect the voice of construction worker and strive for better welfare for the construction worker in term of safety. Common objectives should be compromise among existing segmented trade union.

### 9.3 Limitation of study

#### 9.3.1 Low degree of representative

Out of the 250 questionnaires, only 49 valid are collected, resulting in 19.6% response rate. Therefore the results of the regression model may not be very conclusive and representative. Secondly, investigating the factors affecting safety performance in RMAA works is one of the main focuses in this study. However, it is not clear whether the degree of involvement in RMAA of the respondents.

The study can be improved by using a greater sample size, so that the questionnaires result could be more reliable and representative. Face-to-face and one-on-one approach may be a more effective and efficient way in conducting the questionnaire. More data are likely to be collected in this way.

For the qualitative approach, i.e. interview, the range of variety of interviewee is not wide enough. Both Labour Department and the Buildings Department, the two key departments responsible for accident data collection and analysis, had refused to accept the interview. ASD may not representative enough to represent all the government parties in the view of the point of construction safety.

No representatives from the RMAA work can be invited for the interview. All the analysis on cause of accidents in RMAA work is based on literature review and view point of other safety professionals.
9.3.2 Subjective opinion

The result and analysis of the interviews all totally relay on the respondents’ subjective opinion and professional judgement. Obviously, their views may be subject to psychological factors or limitation of their own professional knowledge on the field.

9.4 Further research

This research aims at finding the cause of accident in construction work and RMAA works. There are seven factors ranked in the regression model, which is quite general. Further research can be conducted to evaluation the measures to improve the safety performance and the effectiveness of current enforcement in safety issue. The ineffectiveness of safety enforcement results in actual accident cost and implicit social cost.

Secondly, further research is recommended on the effectiveness of improving safety climate in Hong Kong, as safety climate is found to be the key factors affecting safety performance in this study.
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Appendix I
Sample of Questionnaire
(English Version)
**Construction Safety Questionnaire**

This Questionnaire aims to collecting information regarding construction safety in Hong Kong. The information will solely be used for academic research purposes. Your information is valuable to the study and will be kept confidential. It only takes a few minutes to complete the questionnaire.

Please fax the completed questionnaire to Miss Au at 23844701. If you have any enquiries, please contact Miss Au Chi Ping via pinghaha@hkusua.hku.hk or 62218941.

**A. Background information**

Q.1 Your position in the firm:

Q.2 No. of reportable accident rate of the firm: (in the last 12 months)
   a. <20/1000 workers  b. 21-50/1000 workers  c.51-60/ 1000 workers  
   d. >61/1000 workers

**B. Size of the company**

Q.3 No. of employees in the firm:
   a. <10   b. 11-40   c.41-90   d. 91- 140  e. 141-240   d. >240

Q.4 No. of safety officers employed in the firm:
   a. none   b.1-5   c. 6-10   c.11-20   d.>20

Q.5 Percentage of part-time worker in the company:
   a. <10%   b. 11-20%   c.21-40%   d. 41-60%  e. >60%

Q.6 Average percentage of subcontracting cost in average total contract sum:
   a. <10%   b. 11-20%   c.21-40%   d. 41-60%   e. >60%

**C. Workers**

Q.7 The average education level of the construction workers in the company
   a. and or below F.3   b. F.3-F.5   c. above F.5

Q.8 The percentage of construction worker with Construction Industry Safety Certificate (Green Card)
   a. <50%   b. 50-60%   c.60-70%   d.70-80%   e. 100%

Q.9 Do the workers receive special construction training? Please specify:
Q.10 The high level of subcontracting in Hong Kong construction industry leads to the problem of inadequate training?
   a. Mostly agree   b. Slightly agree   c. Slightly disagree   d. Mostly disagree

D. Working culture
   Q.11 Average contractual time for completing a project:
      a. <1 month   b. 1months-6 months   c.7months-1year   d. 2year-5years   e.>4 years

   Q.12 Average working hours per week:
      a. <43 hours   b. 43-55 hours   c. 55-80 hours   d.>80 hours

   Q.13 Average value of contract
      a. <$100,000   b.$100,001-500,000   c.$500,000-1,000,000   d.$1,000,001-5,000,000
         e.$5,000,000-$10,000,000   d.>$10,000,000

   Q.14 Average number of years of plant used by the firm
      a.< 1 year   b.1-2years   c.2-5years   d.6-10 years   e.>10years

   Q.15 Average number of years of equipment used by the firm
      a.< 1 year   b.1-2years   c.2-5years   d.6-10 years   e.>10years

   Q.16 Average number of month of maintenance check up of plants and equipment
      a. 1month   b.1-2months   c.2-5months   d.6-10months   e.10-12months   f.> 12months

E. Management
   Q.17 Is there any a safety management system in your company? (if no jump to Q.19)
      a. Yes   b. No

   Q.18 How long has it set up the system?
      a. <6 months   b.7-12months   c. 12-24months   d.>24months

   Q.19 Average percentage of safety investment in and average contract
      a. <0.3%   b. 0.3-0.6%   c.0.6-0.8%   d. 0.8-1%   e. >1%

Q.20 The high level of subcontracting in the Hong Kong construction industry leads to
the problem of lack of management control on site?

a. Mostly agree  b. Slightly agree  c. Slightly disagree  d. Mostly disagree

Q.21 Does your company’ safety management system consist of the following components: (put a tick if yes)

<table>
<thead>
<tr>
<th>safety policy</th>
<th>accident investigation system</th>
</tr>
</thead>
<tbody>
<tr>
<td>safety organization</td>
<td>safety promotion programme</td>
</tr>
<tr>
<td>safety training programme</td>
<td>process control programme</td>
</tr>
<tr>
<td></td>
<td>( including permit to work system)</td>
</tr>
<tr>
<td>in-house safety rules</td>
<td>personal protection programme</td>
</tr>
<tr>
<td>safety committee</td>
<td>health assurance programme</td>
</tr>
<tr>
<td>hazardous conditions inspection programme</td>
<td>sub-contractor evaluation and control system</td>
</tr>
<tr>
<td>job hazard analysis</td>
<td>emergency situation plans</td>
</tr>
</tbody>
</table>

F. Human factors

Q.17 When discovering dangers during work, you will:

a. Stop working and inform supervisor
b. Inform supervisor but continue working
c. Continue working

Q.18 Is accident likely occurs when you doing construction work?

a. Most likely
b. Quite likely
c. Least likely

End

Thank you for your time and consideration
Appendix II
Sample of Questionnaire
(Chinese Version)
建築安全問卷

本人為香港大學房地產及建議系三年級學生。本人正撰寫畢業論文，題目為「研究香港小型建築工程意外的原因」，此論文所提及的小型工程包括一切維修、保養、改建及加建等工程。

本人懇請貴工程公司用數分鐘時間填寫一份問卷，而作資料研究之用。貴公司所提供的資料將會保密。

請貴公司將填妥的問卷傳真致2384 4701 区小姐。如有任何疑問，請通過電郵pinghaha@hkusua.hku.hk 或致電62218941 聯絡區智萍小姐。

(於多項選擇題中，請圈出所選的答案)

A. 背景資料

1. 閣下的職位

2. 過去十二個月內公司所發生的建築意外數目：
   a. <20/1000 工人   b. 21-50/1000 工人   c. 51-60/1000 工人   d. >61/1000 工人

B. 公司規模

3. 員工人數
   a. <10   b. 11-40   c. 41-90   d. 91-140   e. 141-240   d. >240

4. 安全主任人數
   a. 無   b. 1-5   c. 6-10   c. 11-20   d. >20

5. 兼職工人的比率
   a. <10%   b. 11-20%   c. 21-40%   d. 41-60%   e. >60%

6. 平均外判佔合約比率
   a. <10%   b. 11-20%   c. 21-40%   d. 41-60%   e. >60%

C. 工人

7. 工人的平均教育水平
   a. 中三或以下   b. 中三至中五   c. 中五以上

8. 擁有建築安全咭「綠咭」的工人比率
   a. <50%   b. 50-60%   c. 60-70%   d. 70-80%   e. 100%
9. 工人有否接受特別培訓，請列明：

10. 你同意香港的嚴重外判問題引致工人培訓不足嗎？
   a. 非常同意   b. 頗同意   c. 頗不同意   d. 非常不同意

D. 工作文化
11. 平均的工程合約時段：
   a. 少於一個月   b. 1-6 個月   c. 7 個月-1 年   d. 2-5 年   e. 多於 4 年

12. 工人平均一星期工作時數：
   a. 少於 43 小時   b. 43-55 小時   c. 55-80 小時   d. 多於 80 小時

13. 平均的工程合約價值
   a. 少於 $100,000   b. $100,001-500,000   c. $500,000-1,000,000
   d. $1,000,001-5,000,000   e. $5,000,000-$10,000,000   d. 多於 $10,000,000

14. 機械（如：起重機）所使用之平均年期
   a. 少於一年   b. 1-2 年   c. 2-5 年   d. 6-10 年   e. 多於 10 年

15. 設備（如：電鑽）所使用之平均年期
   a. 少於一年   b. 1-2 年   c. 2-5 年   d. 6-10 年   e. 多於 10 年

16. 平均檢查機械與設備的次數
   a. 一個月   b. 1-2 個月   b. 2-5 個月   c. 6-10 個月   d. 10-12 個月   f. 多於一年

E. 管理
17. 公司有否安全管理？
   a. 有   b. 無

18. 公司設立安全管理的年期
   a. 少於 6 個月   b. 6-12 個月   c. 12-24 個月   d. 多於 24 個月

19. 平均投資在安全管理佔工程合約的比率
   a. <0.3%   b. 0.3-0.6%   c. 0.6-0.8%   d. 0.8-1%   e. >1%
20. 你同意香港的嚴重外判問題引致地盤安全管理不足嗎?
   a. 非常同意   b. 頗同意   c. 頗不同意   d. 非常不同意

21. 公司的安全管理包括下面哪一項？(可作多個選擇)

<table>
<thead>
<tr>
<th>安全政策</th>
<th>意外調查系統</th>
</tr>
</thead>
<tbody>
<tr>
<td>安全組織</td>
<td>安全推廣計劃</td>
</tr>
<tr>
<td>安全訓練計劃</td>
<td>進程控制計劃</td>
</tr>
<tr>
<td>內部安全指引</td>
<td>個人保護計劃</td>
</tr>
<tr>
<td>安全委員會</td>
<td>健康保險計劃</td>
</tr>
<tr>
<td>危急情況調查計劃</td>
<td>外判制度檢討及控制</td>
</tr>
<tr>
<td>危機分析</td>
<td>突發應變計劃</td>
</tr>
</tbody>
</table>

F. 人為因素
17. 當你工作時發現潛在危機時，你會
   a. 停止工作並向管工報告
   b. 向管工報告，但繼續工作
   c. 不予理會，繼續工作

18. 你認為你工作時可能面對意外嗎?
   a. 非常有可能
   b. 頗有可能
   c. 不大有可能

問卷完
多謝合作
Appendix III

Accidents in Construction Industry of Hong Kong (2000-2004)

(Abstract)

Source: Labour Department

- analysed by Type of Accident -

<table>
<thead>
<tr>
<th>Type of accident</th>
<th>2000</th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>Total</th>
<th>% of Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trapped in or between objects</td>
<td>188 (1)</td>
<td>175</td>
<td>160 (2)</td>
<td>148 (1)</td>
<td>136 (1)</td>
<td>807 (5)</td>
<td>2.3% (4.1%)</td>
</tr>
<tr>
<td>Injured whilst lifting or carrying</td>
<td>1956 (4)</td>
<td>1350</td>
<td>918</td>
<td>712</td>
<td>615</td>
<td>5551 (4)</td>
<td>15.6%</td>
</tr>
<tr>
<td>Slip, trip or fall on same level</td>
<td>2208 (13)</td>
<td>1741</td>
<td>1263</td>
<td>833  (1)</td>
<td>662</td>
<td>6642 (1)</td>
<td>18.7% (0.8%)</td>
</tr>
<tr>
<td>Fall of person from height</td>
<td>1021 (13)</td>
<td>771 (9)</td>
<td>652 (15)</td>
<td>503 (9)</td>
<td>447 (8)</td>
<td>3294 (54)</td>
<td>9.5% (43.9%)</td>
</tr>
<tr>
<td>Striking against fixed or stationary object</td>
<td>1465 (1)</td>
<td>1140</td>
<td>790</td>
<td>510</td>
<td>458</td>
<td>4363 (12)</td>
<td>12.3%</td>
</tr>
<tr>
<td>Striking against or struck by moving object</td>
<td>2817 (2)</td>
<td>2162 (2)</td>
<td>1202 (1)</td>
<td>747 (1)</td>
<td>757 (3)</td>
<td>7775 (7)</td>
<td>21.0% (5.7%)</td>
</tr>
<tr>
<td>Stepping on object</td>
<td>202</td>
<td>123</td>
<td>77</td>
<td>35</td>
<td>33</td>
<td>470</td>
<td>1.3%</td>
</tr>
<tr>
<td>Exposure to or contact with harmful substance</td>
<td>80 (2)</td>
<td>77</td>
<td>42</td>
<td>27</td>
<td>16</td>
<td>242 (2)</td>
<td>0.7% (1.5%)</td>
</tr>
<tr>
<td>Contact with electricity or electric discharge</td>
<td>24 (5)</td>
<td>29 (4)</td>
<td>18</td>
<td>24 (3)</td>
<td>16 (1)</td>
<td>111 (13)</td>
<td>0.3% (10.6%)</td>
</tr>
<tr>
<td>Trapped by collapsing or overturning object</td>
<td>48 (2)</td>
<td>36 (9)</td>
<td>18 (2)</td>
<td>20 (2)</td>
<td>11 (1)</td>
<td>133 (15)</td>
<td>0.4% (13.0%)</td>
</tr>
<tr>
<td>Struck by falling object</td>
<td>400 (2)</td>
<td>346 (2)</td>
<td>242 (3)</td>
<td>237 (3)</td>
<td>139 (3)</td>
<td>1364 (14)</td>
<td>3.8% (11.4%)</td>
</tr>
<tr>
<td>Struck by moving vehicle</td>
<td>43</td>
<td>46 (1)</td>
<td>24</td>
<td>27</td>
<td>32</td>
<td>172 (1)</td>
<td>0.5% (0.8%)</td>
</tr>
<tr>
<td>Contact with moving machinery or object being machined</td>
<td>683 (2)</td>
<td>621</td>
<td>372</td>
<td>267 (1)</td>
<td>270</td>
<td>2213 (3)</td>
<td>6.2% (2.4%)</td>
</tr>
<tr>
<td>Drowning</td>
<td>0</td>
<td>1 (1)</td>
<td>1 (1)</td>
<td>2 (2)</td>
<td>0</td>
<td>4 (3)</td>
<td>0.0% (2.4%)</td>
</tr>
<tr>
<td>Exposure to fire</td>
<td>25</td>
<td>24 (17)</td>
<td>12 (1)</td>
<td>10</td>
<td>88 (1)</td>
<td>2.0% (0.8%)</td>
<td></td>
</tr>
<tr>
<td>Exposure to explosion</td>
<td>6</td>
<td>6 (9)</td>
<td>4</td>
<td>8</td>
<td>33</td>
<td>1.1%</td>
<td></td>
</tr>
<tr>
<td>Injured by hand tool</td>
<td>609</td>
<td>420</td>
<td>313</td>
<td>219</td>
<td>171</td>
<td>1734</td>
<td>4.9%</td>
</tr>
<tr>
<td>Injured by fall of ground</td>
<td>4 (1)</td>
<td>5</td>
<td>3</td>
<td>6 (1)</td>
<td>0</td>
<td>18 (2)</td>
<td>0.1% (1.6%)</td>
</tr>
<tr>
<td>Asphyxiation</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Contact with hot surface or substance</td>
<td>98</td>
<td>94</td>
<td>65</td>
<td>19</td>
<td>29</td>
<td>303</td>
<td>0.9%</td>
</tr>
<tr>
<td>Injured by animal</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Injured in workplace violence</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Others</td>
<td>53 (1)</td>
<td>39</td>
<td>21</td>
<td>15</td>
<td>23</td>
<td>151 (1)</td>
<td>0.4% (0.8%)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>11,923 (29)</td>
<td>9,206 (28)</td>
<td>6,239 (24)</td>
<td>4,367 (25)</td>
<td>3,833 (17)</td>
<td>35,570 (123)</td>
<td>100.0% (100.0%)</td>
</tr>
</tbody>
</table>

Notes:
1. Industrial accidents refer to injuries and deaths arising from industrial activities in an industrial undertaking as defined under the Factories and Industrial Undertakings Ordinance.
2. Figures in brackets denote the number of fatalities.
### Industrial Accidents in RMAA Works (2000 to 2004)

- analysed by Type of Accident -

<table>
<thead>
<tr>
<th>Type of accident</th>
<th>2000</th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>Total</th>
<th>% of Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trapped in or between objects</td>
<td>27</td>
<td>19</td>
<td>21</td>
<td>30</td>
<td>29 (1)</td>
<td>125 (1)</td>
<td>1.2% (2.5%)</td>
</tr>
<tr>
<td>Injured whilst lifting or carrying</td>
<td>472</td>
<td>327</td>
<td>241</td>
<td>208</td>
<td>210</td>
<td>1,458</td>
<td>13.4%</td>
</tr>
<tr>
<td>Slip, trip or fall on same level</td>
<td>438</td>
<td>335</td>
<td>215</td>
<td>208 (1)</td>
<td>175</td>
<td>1,371 (1)</td>
<td>12.6% (2.5%)</td>
</tr>
<tr>
<td>Fall of person from height</td>
<td>398 (4)</td>
<td>263 (1)</td>
<td>282 (7)</td>
<td>211 (6)</td>
<td>233 (4)</td>
<td>1,383 (22)</td>
<td>12.7% (55.0%)</td>
</tr>
<tr>
<td>Striking against fixed or stationary object</td>
<td>496</td>
<td>412</td>
<td>317</td>
<td>214</td>
<td>185</td>
<td>1,624</td>
<td>15.0%</td>
</tr>
<tr>
<td>Striking against or struck by moving object</td>
<td>828</td>
<td>596</td>
<td>395 (1)</td>
<td>270</td>
<td>314</td>
<td>2,403 (1)</td>
<td>22.2% (2.5%)</td>
</tr>
<tr>
<td>Stepping on object</td>
<td>38</td>
<td>35</td>
<td>18</td>
<td>9</td>
<td>7</td>
<td>107</td>
<td>1.0%</td>
</tr>
<tr>
<td>Exposure to or contact with harmful substance</td>
<td>35</td>
<td>30</td>
<td>20</td>
<td>5</td>
<td>7</td>
<td>97</td>
<td>0.9%</td>
</tr>
<tr>
<td>Contact with electricity or electric discharge</td>
<td>16 (5)</td>
<td>17 (3)</td>
<td>9</td>
<td>7 (1)</td>
<td>10 (1)</td>
<td>59 (10)</td>
<td>0.5% (25.0%)</td>
</tr>
<tr>
<td>Trapped by collapsing or overturning object</td>
<td>14 (1)</td>
<td>7</td>
<td>6 (1)</td>
<td>4</td>
<td>3</td>
<td>34 (2)</td>
<td>0.3% (5.0%)</td>
</tr>
<tr>
<td>Smuck by falling object</td>
<td>96</td>
<td>88</td>
<td>66 (1)</td>
<td>71</td>
<td>28</td>
<td>349 (1)</td>
<td>3.2% (2.5%)</td>
</tr>
<tr>
<td>Smuck by moving vehicle</td>
<td>8</td>
<td>6</td>
<td>2</td>
<td>11</td>
<td>9</td>
<td>36</td>
<td>0.3%</td>
</tr>
<tr>
<td>Contact with moving machinery or object being machined</td>
<td>223 (2)</td>
<td>213</td>
<td>130</td>
<td>112</td>
<td>127</td>
<td>825 (2)</td>
<td>7.6% (5.0%)</td>
</tr>
<tr>
<td>Drowning</td>
<td>11</td>
<td>7</td>
<td>7</td>
<td>5</td>
<td>37</td>
<td>6</td>
<td>0.3%</td>
</tr>
<tr>
<td>Exposure to fire</td>
<td>4</td>
<td>5</td>
<td>3</td>
<td>3</td>
<td>15</td>
<td>0.1%</td>
<td></td>
</tr>
<tr>
<td>Injured by hand tool</td>
<td>259</td>
<td>198</td>
<td>144</td>
<td>104</td>
<td>92</td>
<td>797</td>
<td>7.3%</td>
</tr>
<tr>
<td>Injured by fall of ground</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>4</td>
<td>0.1%</td>
</tr>
<tr>
<td>Asphyxiation</td>
<td>32</td>
<td>26</td>
<td>21</td>
<td>5</td>
<td>9</td>
<td>93</td>
<td>0.9%</td>
</tr>
<tr>
<td>Contact with hot surface or substance</td>
<td>9</td>
<td>5</td>
<td>6</td>
<td>6</td>
<td>8</td>
<td>34</td>
<td>0.3%</td>
</tr>
<tr>
<td>Injured by animal</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Injured in workplace violence</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Others</td>
<td>3,402 (12)</td>
<td>2,582 (4)</td>
<td>1,925 (10)</td>
<td>1,485 (8)</td>
<td>1,454 (6)</td>
<td>10,848 (40)</td>
<td>100.0% (100.0%)</td>
</tr>
</tbody>
</table>

### Notes:
1. Industrial accidents refer to injuries and deaths arising from industrial activities in an industrial undertaking as defined under the Factories and Industrial Undertakings Ordinance.
2. RMAA means repair, maintenance, alteration and addition and refers to those minor works such as construction projects for village-type houses in the New Territories, minor alterations, repairs, maintenance and interior decoration of existing buildings.
3. Figures in brackets denote the number of fatalities.

- analysed by Month -

<table>
<thead>
<tr>
<th></th>
<th>2000 ( )</th>
<th>2001 ( )</th>
<th>2002 ( )</th>
<th>2003 ( )</th>
<th>2004 ( )</th>
<th>Total ( )</th>
<th>% of Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan</td>
<td>928 (1)</td>
<td>580 (1)</td>
<td>656</td>
<td>360 (2)</td>
<td>190 (1)</td>
<td>2,714 (5)</td>
<td>7.6% (4.1%)</td>
</tr>
<tr>
<td>Feb</td>
<td>579 (2)</td>
<td>758</td>
<td>354 (1)</td>
<td>262 (2)</td>
<td>284 (3)</td>
<td>2,237 (8)</td>
<td>6.3% (6.5%)</td>
</tr>
<tr>
<td>Mar</td>
<td>1,010</td>
<td>934</td>
<td>539 (4)</td>
<td>425 (2)</td>
<td>328 (3)</td>
<td>3,236 (9)</td>
<td>9.1% (7.3%)</td>
</tr>
<tr>
<td>Apr</td>
<td>935 (3)</td>
<td>704 (1)</td>
<td>581 (2)</td>
<td>358</td>
<td>324</td>
<td>2,902 (6)</td>
<td>8.2% (4.9%)</td>
</tr>
<tr>
<td>May</td>
<td>1,133 (4)</td>
<td>941 (2)</td>
<td>564 (2)</td>
<td>420</td>
<td>330</td>
<td>3,388 (8)</td>
<td>9.5% (6.5%)</td>
</tr>
<tr>
<td>Jun</td>
<td>1,123 (1)</td>
<td>794 (4)</td>
<td>584 (2)</td>
<td>352 (7)</td>
<td>365</td>
<td>3,218 (14)</td>
<td>9.0% (11.4%)</td>
</tr>
<tr>
<td>Jul</td>
<td>1,183 (6)</td>
<td>800 (2)</td>
<td>592 (5)</td>
<td>425 (3)</td>
<td>368 (2)</td>
<td>3,368 (18)</td>
<td>9.5% (14.6%)</td>
</tr>
<tr>
<td>Aug</td>
<td>1,235 (5)</td>
<td>937 (4)</td>
<td>551 (2)</td>
<td>406 (4)</td>
<td>390 (3)</td>
<td>3,519 (18)</td>
<td>9.9% (14.6%)</td>
</tr>
<tr>
<td>Sep</td>
<td>1,036 (2)</td>
<td>831 (1)</td>
<td>496 (2)</td>
<td>362 (1)</td>
<td>342 (3)</td>
<td>3,067 (9)</td>
<td>8.6% (7.3%)</td>
</tr>
<tr>
<td>Oct</td>
<td>973 (2)</td>
<td>747 (7)</td>
<td>465 (2)</td>
<td>361 (2)</td>
<td>311 (1)</td>
<td>2,857 (14)</td>
<td>8.0% (11.4%)</td>
</tr>
<tr>
<td>Nov</td>
<td>968 (1)</td>
<td>613 (3)</td>
<td>446</td>
<td>341</td>
<td>310 (1)</td>
<td>2,617 (5)</td>
<td>7.5% (4.1%)</td>
</tr>
<tr>
<td>Dec</td>
<td>822 (2)</td>
<td>567 (3)</td>
<td>411 (2)</td>
<td>295 (2)</td>
<td>291</td>
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<tr>
<td>Total</td>
<td>11,925 (29)</td>
<td>9,206 (28)</td>
<td>6,239 (24)</td>
<td>4,367 (25)</td>
<td>3,833 (17)</td>
<td>35,570 (123)</td>
<td>100.0% (100.0%)</td>
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### Notes:
1. Industrial accidents refer to injuries and deaths arising from industrial activities in an industrial undertaking as defined under the Factories and Industrial Undertakings Ordinance.
2. Figures in brackets denote the number of fatalities.
## Industrial Accidents in RMAA Works (2000 to 2004)

- analysed by Month -

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<th></th>
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<th>2001</th>
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<th>2003</th>
<th>2004</th>
<th>Total</th>
<th>% of Total</th>
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<td>185</td>
<td>120</td>
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<tr>
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<td>152</td>
<td>195</td>
<td>99</td>
<td>86</td>
<td>91</td>
<td>623</td>
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<td>296</td>
<td>245</td>
<td>173</td>
<td>120</td>
<td>110</td>
<td>944</td>
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<tr>
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<td>256</td>
<td>209</td>
<td>160</td>
<td>112</td>
<td>112</td>
<td>849</td>
<td>7.8% (7.5%)</td>
</tr>
<tr>
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<td>328</td>
<td>259</td>
<td>180</td>
<td>132</td>
<td>136</td>
<td>1035</td>
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<td>175</td>
<td>112</td>
<td>139</td>
<td>982</td>
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<td>187</td>
<td>156</td>
<td>127</td>
<td>1072</td>
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<tr>
<td>Aug</td>
<td>363</td>
<td>305</td>
<td>189</td>
<td>159</td>
<td>149</td>
<td>1165</td>
<td>10.7% (20.0%)</td>
</tr>
<tr>
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<td>270</td>
<td>221</td>
<td>180</td>
<td>125</td>
<td>142</td>
<td>938</td>
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<td>218</td>
<td>133</td>
<td>130</td>
<td>129</td>
<td>884</td>
<td>8.1% (12.5%)</td>
</tr>
<tr>
<td>Nov</td>
<td>270</td>
<td>178</td>
<td>118</td>
<td>131</td>
<td>125</td>
<td>822</td>
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<tr>
<td>Dec</td>
<td>225</td>
<td>156</td>
<td>146</td>
<td>102</td>
<td>136</td>
<td>765</td>
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<td><strong>Total</strong></td>
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<td><strong>2582 (4)</strong></td>
<td><strong>1925 (10)</strong></td>
<td><strong>1485 (8)</strong></td>
<td><strong>1454 (6)</strong></td>
<td><strong>10848 (40)</strong></td>
<td><strong>100.0% (100.0%)</strong></td>
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</tbody>
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Notes:
1. Industrial accidents refer to injuries and deaths arising from industrial activities in an industrial undertaking as defined under the Factories and Industrial Undertakings Ordinance.
2. RMAA means repair, maintenance, alteration and addition and refers to those minor works such as construction projects for village-type houses in the New Territories, minor alterations, repairs, maintenance and interior decoration of existing buildings.
3. Figures in brackets denote the number of fatalities.
### Appendices

- analysed by Type of Work being Performed.

<table>
<thead>
<tr>
<th>Type of work</th>
<th>2000</th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>Total</th>
<th>% of Total</th>
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<td>141</td>
<td>1625</td>
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<td>236</td>
<td>169</td>
<td>119</td>
<td>1609</td>
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<td>163</td>
<td>137</td>
<td>123</td>
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<td>196</td>
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<td>185</td>
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<td>69</td>
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<td>252</td>
<td>138</td>
<td>86</td>
<td>85</td>
<td>816</td>
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<td>222</td>
<td>107</td>
<td>83</td>
<td>67</td>
<td>788</td>
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<td>125</td>
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<td>65</td>
<td>67</td>
<td>638</td>
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<td>105</td>
<td>104</td>
<td>62</td>
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<td>85</td>
<td>64</td>
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<td>106</td>
<td>62</td>
<td>42</td>
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<td>1.7%</td>
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<td>111</td>
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<td>74</td>
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<td>76</td>
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<td>19</td>
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<td>43</td>
<td>37</td>
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<td>0.7%</td>
</tr>
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<td>64</td>
<td>50</td>
<td>18</td>
<td>18</td>
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<td>39</td>
<td>42</td>
<td>19</td>
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<tr>
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<td>55</td>
<td>31</td>
<td>52</td>
<td>13</td>
<td>2</td>
<td>153</td>
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</tr>
<tr>
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<td>33</td>
<td>16</td>
<td>7</td>
<td>138</td>
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<td>29</td>
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<td>21</td>
<td>28</td>
<td>19</td>
<td>130</td>
<td>0.4%</td>
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<tr>
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<td>26</td>
<td>18</td>
<td>25</td>
<td>22</td>
<td>22</td>
<td>111</td>
<td>0.3%</td>
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<tr>
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<td>9</td>
<td>11</td>
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<td>0</td>
<td>2</td>
<td>24</td>
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<td>1</td>
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</tr>
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<td>0</td>
<td>0</td>
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<tr>
<td>Others</td>
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<td>793</td>
<td>328</td>
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<tr>
<td><strong>Total</strong></td>
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<td>6,239</td>
<td>4,167</td>
<td>3,833</td>
<td>35,760</td>
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### Industrial Accidents in RMAA Works (2000 to 2004)

- analysed by Type of Work being Performed -

<table>
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<tr>
<th>Type of work</th>
<th>2000</th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>Total</th>
<th>% of Total</th>
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</thead>
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<td>210</td>
<td>181</td>
<td>168</td>
<td>364</td>
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<td>199</td>
<td>134</td>
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<td>107</td>
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<td>652</td>
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<td>55</td>
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<td>42</td>
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<td>106</td>
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<td>24</td>
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<td>133</td>
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<td>3</td>
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<td>5</td>
<td>3</td>
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<td>2</td>
<td>6</td>
<td>23</td>
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<td>1</td>
<td>1</td>
<td>12</td>
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<td>3</td>
<td>1</td>
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<td>11</td>
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<td>1</td>
<td>1</td>
<td>5</td>
<td>10</td>
<td>0.1%</td>
</tr>
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<td>1</td>
<td>2</td>
<td>2</td>
<td>6</td>
<td>0.0%</td>
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<td>1</td>
<td>1</td>
<td>1</td>
<td>4</td>
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<td>1,485</td>
<td>1,454</td>
<td>10,848</td>
<td>100.0% (100.0%)</td>
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</table>

**Notes:**

1. Industrial accident refer to injuries and deaths arising from industrial activities as defined under the Factories and Industrial Undertakings Ordinance.
2. RMAA means repair, maintenance, alteration and addition and refers to those minor works such as construction projects for village-type houses in the New Territories, minor alterations, repairs, maintenance and interior decoration of existing buildings.
3. Figures in brackets denote the number of facilities.
Industrial Accidents (Fall of Person from Height) in Construction Industry (2000 to 2004)

- analysed by Injury Nature -

<table>
<thead>
<tr>
<th>Nature of injury</th>
<th>2000</th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>Total</th>
<th>% of Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contusion &amp; bruise</td>
<td>398 (3)</td>
<td>292</td>
<td>234 (5)</td>
<td>173 (1)</td>
<td>135 (2)</td>
<td>1 232 (11)</td>
<td>36.3% (20.4%)</td>
</tr>
<tr>
<td>Fracture</td>
<td>262</td>
<td>196</td>
<td>199</td>
<td>169</td>
<td>129</td>
<td>955</td>
<td>28.1%</td>
</tr>
<tr>
<td>Sprain &amp; strain</td>
<td>161</td>
<td>112</td>
<td>84</td>
<td>62</td>
<td>56</td>
<td>475</td>
<td>14.0%</td>
</tr>
<tr>
<td>Multiple injuries</td>
<td>94 (9)</td>
<td>114 (9)</td>
<td>71 (10)</td>
<td>54 (7)</td>
<td>80 (6)</td>
<td>413 (41)</td>
<td>12.2% (75.9%)</td>
</tr>
<tr>
<td>Laceration and cut</td>
<td>36</td>
<td>23</td>
<td>16</td>
<td>18</td>
<td>15</td>
<td>108</td>
<td>3.2%</td>
</tr>
<tr>
<td>Abrasion</td>
<td>32</td>
<td>17</td>
<td>16</td>
<td>11</td>
<td>13</td>
<td>89</td>
<td>2.6%</td>
</tr>
<tr>
<td>Dislocation</td>
<td>20</td>
<td>9</td>
<td>16</td>
<td>9</td>
<td>9</td>
<td>63</td>
<td>1.9%</td>
</tr>
<tr>
<td>Crushing</td>
<td>11</td>
<td>4</td>
<td>10</td>
<td>4</td>
<td>5</td>
<td>34</td>
<td>1.0%</td>
</tr>
<tr>
<td>Puncture wound</td>
<td>3</td>
<td>3</td>
<td>5</td>
<td>2 (1)</td>
<td>0</td>
<td>13 (1)</td>
<td>0.4% (1.9%)</td>
</tr>
<tr>
<td>Concussion</td>
<td>3 (1)</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>6 (1)</td>
<td>0.2% (1.9%)</td>
</tr>
<tr>
<td>Amputation</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>3</td>
<td>0.1%</td>
</tr>
<tr>
<td>Others</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
<td>0.1%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>1 021 (13)</td>
<td>771 (9)</td>
<td>652 (15)</td>
<td>503 (9)</td>
<td>447 (8)</td>
<td>3 394 (34)</td>
<td>100.0% (100.0%)</td>
</tr>
</tbody>
</table>

Notes:
1. Industrial accidents refer to injuries and deaths arising from industrial activities in an industrial undertaking as defined under the Factories and Industrial Undertakings Ordinance.
2. Figures in brackets denote the number of fatalities.
## Industrial Accidents (Fall of Person from Height) in RMAA Works (2000 to 2004)

- analysed by Injury Nature -

<table>
<thead>
<tr>
<th>Nature of injury</th>
<th>2000</th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>Total</th>
<th>% of Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contusion &amp; bruise</td>
<td>141 (1)</td>
<td>89</td>
<td>93 (3)</td>
<td>70</td>
<td>69 (1)</td>
<td>462 (5)</td>
<td>33.4% (22.7%)</td>
</tr>
<tr>
<td>Fracture</td>
<td>116</td>
<td>72</td>
<td>97</td>
<td>72</td>
<td>65</td>
<td>422</td>
<td>30.5%</td>
</tr>
<tr>
<td>Sprain &amp; strain</td>
<td>65</td>
<td>46</td>
<td>40</td>
<td>24</td>
<td>24</td>
<td>199</td>
<td>14.4%</td>
</tr>
<tr>
<td>Multiple injuries</td>
<td>36 (2)</td>
<td>38 (1)</td>
<td>25 (4)</td>
<td>28 (6)</td>
<td>50 (3)</td>
<td>177 (16)</td>
<td>12.8% (72.7%)</td>
</tr>
<tr>
<td>Laceration and cut</td>
<td>15</td>
<td>8</td>
<td>6</td>
<td>8</td>
<td>6</td>
<td>43</td>
<td>3.1%</td>
</tr>
<tr>
<td>Abrasion</td>
<td>12</td>
<td>5</td>
<td>5</td>
<td>3</td>
<td>8</td>
<td>33</td>
<td>2.4%</td>
</tr>
<tr>
<td>Dislocation</td>
<td>3</td>
<td>2</td>
<td>7</td>
<td>4</td>
<td>5</td>
<td>21</td>
<td>1.5%</td>
</tr>
<tr>
<td>Crushing</td>
<td>6</td>
<td>1</td>
<td>8</td>
<td>1</td>
<td>4</td>
<td>20</td>
<td>1.4%</td>
</tr>
<tr>
<td>Concussion</td>
<td>1 (1)</td>
<td></td>
<td>1</td>
<td>1</td>
<td></td>
<td>3 (1)</td>
<td>0.2% (4.5%)</td>
</tr>
<tr>
<td>Amputation</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>2</td>
<td>0.1%</td>
</tr>
<tr>
<td>Others</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>0.1%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>396 (4)</td>
<td>261 (1)</td>
<td>282 (7)</td>
<td>211 (6)</td>
<td>233 (4)</td>
<td>1383 (22)</td>
<td>100.0% (100.0%)</td>
</tr>
</tbody>
</table>

Notes:
1. Industrial accidents refer to injuries and deaths arising from industrial activities in an industrial undertaking as defined under the Factories and Industrial Undertakings Ordinance.
2. RMAA means repair, maintenance, alteration and addition and refers to those minor works such as construction projects for village-type houses in the New Territories, minor alterations, repairs, maintenance and interior decoration of existing buildings.
3. Figures in brackets denote the number of fatalities.
### Industrial Accidents in RMAA Works (2000 to 2004)
- analysed by Age Group -

<table>
<thead>
<tr>
<th>Age</th>
<th>2000</th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>Total</th>
<th>% of Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>15-17</td>
<td>38</td>
<td>13</td>
<td>10</td>
<td>1</td>
<td>8</td>
<td>70</td>
<td>0.6%</td>
</tr>
<tr>
<td>18-19</td>
<td>137</td>
<td>90</td>
<td>58 (1)</td>
<td>27</td>
<td>22</td>
<td>334 (1)</td>
<td>3.1% (2.5%)</td>
</tr>
<tr>
<td>20-24</td>
<td>466 (2)</td>
<td>315</td>
<td>230</td>
<td>182 (1)</td>
<td>170 (1)</td>
<td>1 363 (4)</td>
<td>12.6% (10.0%)</td>
</tr>
<tr>
<td>25-29</td>
<td>384 (2)</td>
<td>319 (1)</td>
<td>247 (3)</td>
<td>213 (1)</td>
<td>190</td>
<td>1 353 (7)</td>
<td>12.5% (17.5%)</td>
</tr>
<tr>
<td>30-34</td>
<td>380 (4)</td>
<td>286 (1)</td>
<td>235 (3)</td>
<td>175</td>
<td>176 (1)</td>
<td>1 252 (9)</td>
<td>11.5% (22.5%)</td>
</tr>
<tr>
<td>35-39</td>
<td>515 (1)</td>
<td>391 (1)</td>
<td>212</td>
<td>172</td>
<td>171</td>
<td>1 461 (2)</td>
<td>13.5% (5.0%)</td>
</tr>
<tr>
<td>40-44</td>
<td>659</td>
<td>469 (1)</td>
<td>374 (1)</td>
<td>238 (1)</td>
<td>236 (1)</td>
<td>1 976 (4)</td>
<td>18.2% (10.0%)</td>
</tr>
<tr>
<td>45-49</td>
<td>398 (2)</td>
<td>346</td>
<td>295 (1)</td>
<td>248 (4)</td>
<td>225</td>
<td>1 512 (7)</td>
<td>13.9% (17.5%)</td>
</tr>
<tr>
<td>50-54</td>
<td>232</td>
<td>201</td>
<td>147 (1)</td>
<td>122</td>
<td>154 (1)</td>
<td>856 (2)</td>
<td>7.9% (5.0%)</td>
</tr>
<tr>
<td>55-59</td>
<td>113 (1)</td>
<td>98</td>
<td>80</td>
<td>76 (2)</td>
<td>76 (2)</td>
<td>443 (3)</td>
<td>4.1% (7.5%)</td>
</tr>
<tr>
<td>60-64</td>
<td>57</td>
<td>35</td>
<td>31</td>
<td>20</td>
<td>22</td>
<td>165</td>
<td>1.5%</td>
</tr>
<tr>
<td>&gt;64</td>
<td>23</td>
<td>19</td>
<td>6</td>
<td>11 (1)</td>
<td>4</td>
<td>63 (1)</td>
<td>0.6% (2.5%)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>3 402 (12)</td>
<td>2 382 (4)</td>
<td>1 925 (10)</td>
<td>1 485 (8)</td>
<td>1 454 (6)</td>
<td>10 848 (40)</td>
<td>100.0% (100.0%)</td>
</tr>
</tbody>
</table>

**Notes:**
1. Industrial accidents refer to injuries and deaths arising from industrial activities in an industrial undertaking as defined under the Factories and Industrial Undertakings Ordinance.
2. RMAA means repair, maintenance, alteration and addition and refers to those minor works such as construction projects for village-type houses in the New Territories, minor alterations, repairs, maintenance and interior decoration of existing buildings.
3. Figures in brackets denote the number of fatalities.
### Industrial Accidents in RMAA Works (2000 to 2004)

- analysed by Sex -

<table>
<thead>
<tr>
<th></th>
<th>2000</th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>Total</th>
<th>% of Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>43</td>
<td>36</td>
<td>42</td>
<td>33</td>
<td>34</td>
<td>188</td>
<td>1.7%</td>
</tr>
<tr>
<td>Male</td>
<td>3359 (12)</td>
<td>2546 (4)</td>
<td>1883 (10)</td>
<td>1452 (8)</td>
<td>1420 (6)</td>
<td>10660 (40)</td>
<td>98.3% (100.0%)</td>
</tr>
<tr>
<td>Total</td>
<td>3402 (12)</td>
<td>2582 (4)</td>
<td>1925 (10)</td>
<td>1485 (8)</td>
<td>1454 (6)</td>
<td>10848 (40)</td>
<td>100.0% (100.0%)</td>
</tr>
</tbody>
</table>

Notes:
1. Industrial accidents refer to injuries and deaths arising from industrial activities in an industrial undertaking as defined under the Factories and Industrial Undertakings Ordinance.
2. RMAA means repair, maintenance, alteration and addition and refers to those minor works such as construction projects for village-type houses in the New Territories, minor alterations, repairs, maintenance and interior decoration of existing buildings.
3. Figures in brackets denote the number of fatalities.
Appendix IV
Sample of Contract Documents
Included in PFSS & ISAS
## Appendix I(c) - Sample Bill of Quantities for works contracts included in PFSS

Based on $100M contract value over 2 years

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Description</th>
<th>Quantity</th>
<th>Unit</th>
<th>Rate</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Complete draft Safety Plan</td>
<td>-</td>
<td>item</td>
<td>20,000</td>
<td>20,000</td>
</tr>
<tr>
<td></td>
<td>(not &gt; 1.0% of the estimate of total safety payment)*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>Complete Safety Plan</td>
<td>-</td>
<td>item</td>
<td>30,000</td>
<td>30,000</td>
</tr>
<tr>
<td></td>
<td>(not &gt; 1.5% of the estimate of total safety payment)*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>Updating of Safety Plan</td>
<td>24</td>
<td>mth</td>
<td>2,000</td>
<td>48,000</td>
</tr>
<tr>
<td>D</td>
<td>Provide Safety Officer</td>
<td>24</td>
<td>ur-mth</td>
<td>20,000</td>
<td>480,000</td>
</tr>
<tr>
<td>E</td>
<td>Attend Site Safety Management Committee</td>
<td>24</td>
<td>mth</td>
<td>2,000</td>
<td>48,000</td>
</tr>
<tr>
<td>F</td>
<td>Attend Site Safety Committee</td>
<td>24</td>
<td>mth</td>
<td>2,000</td>
<td>48,000</td>
</tr>
<tr>
<td>G</td>
<td>Arrange and attend weekly safety walk</td>
<td>104</td>
<td>ur</td>
<td>7,500</td>
<td>780,000</td>
</tr>
<tr>
<td>H**</td>
<td>Provide safety training in the form of trade specific advanced safety training to skilled workers</td>
<td>200</td>
<td>ur</td>
<td>650</td>
<td>130,000</td>
</tr>
<tr>
<td>I**</td>
<td>Provide safety training in the form of site specific induction training</td>
<td>700</td>
<td>ur</td>
<td>100</td>
<td>70,000</td>
</tr>
<tr>
<td>J**</td>
<td>Provide safety training in the form of tool box talks</td>
<td>7,000</td>
<td>ur</td>
<td>40</td>
<td>280,000</td>
</tr>
<tr>
<td>K***</td>
<td>Provisional Sum</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Participate in safety promotional campaign as instructed by the Architect/Engineer*</td>
<td></td>
<td>sum</td>
<td></td>
<td>30,000</td>
</tr>
</tbody>
</table>

| Total to Collection Sheet | 1,864,000 |

Notes:-

* The words in brackets are for guidance only and should not be entered in the Bills of Quantities.

** The rate for items H, I and J are fixed and should not be adjusted upwards or downwards even if the value of the contract is greater than or below $100M, but the quantities can be adjusted in accordance with the content of works under that contract.

*** The amount for item K is fixed and should not be adjusted.

mth = month
ur = number
ur-mth = number-month
Appendices

Appendix II(a) - Sample Schedule of Rates for term contracts included in PfSS

Based on total estimated expenditure of $100M over 2 years

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Description</th>
<th>Quantity#</th>
<th>Unit</th>
<th>Scheduled Rate</th>
<th>Amount#</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Complete draft Safety Plan (not &gt; 1.0% of the estimate of total safety payment)*</td>
<td>-</td>
<td>item</td>
<td>20,000</td>
<td>20,000</td>
</tr>
<tr>
<td>B</td>
<td>Complete Safety Plan (not &gt; 1.5% of the estimate of total safety payment)*</td>
<td>-</td>
<td>item</td>
<td>30,000</td>
<td>30,000</td>
</tr>
<tr>
<td>C</td>
<td>Updating of Safety Plan</td>
<td>24</td>
<td>mth</td>
<td>2,000</td>
<td>48,000</td>
</tr>
<tr>
<td>D</td>
<td>Provide Safety Officer</td>
<td>24</td>
<td>nr-mth</td>
<td>20,000</td>
<td>480,000</td>
</tr>
<tr>
<td>E</td>
<td>Attend Site Safety Management Committee</td>
<td>24</td>
<td>mth</td>
<td>2,000</td>
<td>48,000</td>
</tr>
<tr>
<td>F</td>
<td>Attend Site Safety Committee</td>
<td>24</td>
<td>mth</td>
<td>2,000</td>
<td>48,000</td>
</tr>
<tr>
<td>G</td>
<td>Arrange and attend weekly safety walk</td>
<td>104</td>
<td>nr</td>
<td>7,500</td>
<td>780,000</td>
</tr>
<tr>
<td>H**</td>
<td>Provide safety training in the form of trade specific advanced safety training to skilled workers</td>
<td>200</td>
<td>nr</td>
<td>650</td>
<td>130,000</td>
</tr>
<tr>
<td>J**</td>
<td>Provide safety training in the form of site specific induction training</td>
<td>700</td>
<td>nr</td>
<td>100</td>
<td>70,000</td>
</tr>
<tr>
<td>J**</td>
<td>Provide safety training in the form of tool box talks</td>
<td>7,000</td>
<td>nr</td>
<td>40</td>
<td>280,000</td>
</tr>
<tr>
<td>K#</td>
<td>Participate in safety promotional campaign as instructed by the Architect/Engineer* (Provisional Sum)</td>
<td></td>
<td>sum</td>
<td>30,000</td>
<td></td>
</tr>
</tbody>
</table>

Total to Collection Sheet | 1,964,000

Notes:
(*) The words in brackets are for guidance only and should not be entered in the Schedule of Rates.
** The rates for items H, I, and J are fixed and should not be adjusted upwards or downwards even if the value of the contract is greater than or below $100M, but the quantities can be adjusted in accordance with the content of works under that contract.
# The shaded columns and item K are for illustration purpose and should not be included in the Schedule of Rates. Item K is to be issued via a Works Order.

mth month
r number
nr-mth number-month
Appendix II(c) – Sample Summary of Tender for lump sum works contracts included in PFSS showing how the Provisional Sum is included

<table>
<thead>
<tr>
<th>Page</th>
<th>$</th>
<th>£</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. SPECIFICATION PRELIMINARIES</td>
<td>( )*</td>
<td></td>
</tr>
</tbody>
</table>
| 2. SCHEDULE OF RATES  
(to be submitted by the Contractor) |  
Section A – Contractor’s Designed piled Foundations | ( )* | |
|  
Section B – Contractor’s Designed Pile Caps and Strap Beams | ( )* | |
|  
Section C – Ancillary Work | ( )* | |
| 3. PROVISIONAL SUM |  
Provide the following sum to be expended in part or in whole as directed by the Architect/Engineer* or wholly deducted from the Contract Sum if not required. |  
Provide the Provisional Sum of $ 1,964,000 for establishing and implementing the site safety management system including participating in safety promotional campaign as required under the Contract. The Contractor shall be paid in accordance with the Method of Measurement and the pre-fixed rates for the items included in the Schedule of Rates for PFSS in Appendix *** to the Specification. | sum ***1,964,000 00 |
| 4. CONTINGENCY SUM |  
Contingency Sum | sum **2,000,000 00 |

TOTAL CARRIED TO FORM OF TENDER $

Note:
* Amount to be inserted by the tenderer
** Amount fixed by the Architect/Engineer/Supervising Officer for the Contract
*** This sum shall match with that in the SOR (prepared in accordance with the sample SOR in Appendix II(b)) and provided to the tenderers.
Appendices

**Appendix III(a) - Sample Bill of Quantities for works contracts included in both PFSS and ISAS**

Based on $100M contract value over 2 years

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Description</th>
<th>Quantity</th>
<th>Unit</th>
<th>Rate</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Complete draft Safety Plan (not &gt;1.0% of the estimate of total safety payment)*</td>
<td>-</td>
<td>Item</td>
<td>20,000</td>
<td>20,000</td>
</tr>
<tr>
<td>B</td>
<td>Complete Safety Plan (not &gt; 1.5% of the estimate of total safety payment)*</td>
<td>-</td>
<td>Item</td>
<td>30,000</td>
<td>30,000</td>
</tr>
<tr>
<td>C</td>
<td>Updating of Safety Plan</td>
<td>24</td>
<td>Mth</td>
<td>2,000</td>
<td>48,000</td>
</tr>
<tr>
<td>D</td>
<td>Provide Safety Officer</td>
<td>24</td>
<td>m-mth</td>
<td>20,000</td>
<td>480,000</td>
</tr>
<tr>
<td>E</td>
<td>Attend Site Safety Management Committee</td>
<td>24</td>
<td>Mth</td>
<td>2,000</td>
<td>48,000</td>
</tr>
<tr>
<td>F</td>
<td>Attend Site Safety Committee</td>
<td>24</td>
<td>Mth</td>
<td>2,000</td>
<td>48,000</td>
</tr>
<tr>
<td>G</td>
<td>Arrange and attend weekly safety walk</td>
<td>104</td>
<td>Nr</td>
<td>4,000</td>
<td>416,000</td>
</tr>
<tr>
<td>H**</td>
<td>Provide safety training in the form of trade specific advanced safety training to skilled workers</td>
<td>200</td>
<td>Nr</td>
<td>650</td>
<td>130,000</td>
</tr>
<tr>
<td>I**</td>
<td>Provide safety training in the form of site specific induction training</td>
<td>700</td>
<td>Nr</td>
<td>100</td>
<td>70,000</td>
</tr>
<tr>
<td>J**</td>
<td>Provide safety training in the form of tool box training</td>
<td>7,000</td>
<td>Nr</td>
<td>40</td>
<td>280,000</td>
</tr>
<tr>
<td>K***</td>
<td>Participate in safety promotional campaign as instructed by the Architect/Engineer* (Provisional Sum)</td>
<td></td>
<td>Sum</td>
<td></td>
<td>30,000</td>
</tr>
<tr>
<td>L</td>
<td>Safety audit (Approx 25% of estimate of the total safety payments)*</td>
<td>8</td>
<td>Nr</td>
<td>60,000</td>
<td>480,000</td>
</tr>
<tr>
<td>M+</td>
<td>Attendance on Safety Auditor</td>
<td>8</td>
<td>Nr</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Total to Collection Sheet: 2,080,000

**Notes:**
- The words in brackets are for guidance only and should not be entered in the Bills of Quantities.
- The rates for items H, I, and J are fixed and should not be adjusted upwards or downwards even if the value of the contract is greater than or below $100M, but the quantities can be adjusted in accordance with the content of works under that contract.
- The amount for item K is fixed and should not be adjusted.
- Rate for item M to be inserted by the Contractor

<table>
<thead>
<tr>
<th>Code</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>mth</td>
<td>month</td>
</tr>
<tr>
<td>nr</td>
<td>number</td>
</tr>
<tr>
<td>m-mth</td>
<td>number-month</td>
</tr>
</tbody>
</table>
Appendices

Appendix III(b) - Sample Schedule of Rates for term contracts included in both PPSS and ISAS

Based on total estimated expenditure of $100M over 2 years

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Description</th>
<th>Quantity#</th>
<th>Unit</th>
<th>Scheduled Rate</th>
<th>Amount#</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Complete draft Safety Plan (not &gt; 1.0% of the estimate of total safety payment)*</td>
<td>-</td>
<td>item</td>
<td>20,000</td>
<td>20,000</td>
</tr>
<tr>
<td>B</td>
<td>Complete Safety Plan (not &gt; 1.5% of the estimate of total safety payment)*</td>
<td>-</td>
<td>item</td>
<td>30,000</td>
<td>30,000</td>
</tr>
<tr>
<td>C</td>
<td>Updating of Safety Plan</td>
<td>24</td>
<td>mth</td>
<td>3,000</td>
<td>72,000</td>
</tr>
<tr>
<td>D</td>
<td>Provide Safety Officer</td>
<td>24</td>
<td>m-th</td>
<td>20,000</td>
<td>480,000</td>
</tr>
<tr>
<td>E</td>
<td>Attend Site Safety Management Committee</td>
<td>24</td>
<td>mth</td>
<td>2,000</td>
<td>48,000</td>
</tr>
<tr>
<td>F</td>
<td>Attend Site Safety Committee</td>
<td>24</td>
<td>mth</td>
<td>2,000</td>
<td>48,000</td>
</tr>
<tr>
<td>G</td>
<td>Arrange and attend weekly safety walk</td>
<td>104</td>
<td>nr</td>
<td>4,000</td>
<td>416,000</td>
</tr>
<tr>
<td>H**</td>
<td>Provide safety training in the form of trade specific advanced safety training to skilled workers</td>
<td>200</td>
<td>nr</td>
<td>650</td>
<td>130,000</td>
</tr>
<tr>
<td>I**</td>
<td>Provide safety training in the form of site specific induction training</td>
<td>700</td>
<td>nr</td>
<td>100</td>
<td>70,000</td>
</tr>
<tr>
<td>J**</td>
<td>Provide safety training in the form of tool box talks</td>
<td>7,000</td>
<td>nr</td>
<td>40</td>
<td>280,000</td>
</tr>
<tr>
<td>K</td>
<td>Safety Audit (Approx. 25% of estimate of the total safety payments)*</td>
<td>8</td>
<td>nr</td>
<td>60,000</td>
<td>480,000</td>
</tr>
<tr>
<td>L+</td>
<td>Attendance on Safety Auditor</td>
<td>8</td>
<td>nr</td>
<td>2,000+</td>
<td>16,000</td>
</tr>
<tr>
<td>M#</td>
<td>Provisional Sum: Participate in safety promotional campaign as instructed by the Architect/Engineer</td>
<td>sum</td>
<td></td>
<td>30,000</td>
<td>30,000</td>
</tr>
</tbody>
</table>

Total to Collection Sheet: 2,120,000

Notes:
(*) The words in brackets are for guidance only and should not be entered in the Schedule of Rates.
** The rates for Items H, I, and J are fixed and should not be adjusted upwards or downwards even if the value of the contract is greater than or below $100M, but the quantities can be adjusted in accordance with the content of works under that contract.
# The shaded columns and item M (a provisional sum item) are for illustration purpose and should not be included in the Schedule of Rates.
+ This item is to be placed in the Section for "preliminary" items and its rate is to be subject to competitive tendering by the Contractor; for term contracts with rates to be inserted by the Contractor, the rate of $2,000 should be omitted and the Contractor allowed to insert his own rate in the schedule.
mth month
nr number
m-th mth number-month