

**RISK ASSESSMENT FOR DEMOLITION WORKS IN MALAYSIA**

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## ABSTRACT

This research is aimed at developing an overview as well as assessing the potential hazard involve in demolition operations in Malaysia. It intends to generate perspective insight into the current state of demolition works which in turn, will be beneficially applied to serve as a solid platform for future research and development. This research is divided into three parts. The first part involves the case study of two demolition project that has been carried out which is Lumba Kuda Flats in Johor Bahru and Pekeliling Flats in Kuala Lumpur. Both of the case studies have shown that although risk management was included in the health and safety plan, it only covers the surface of the problem area by only referring to Factories and Machinery Act 1974, Occupational Safety and Health Act 1994 or base on previous project report. The second part of the research is discussion with expert regarding the problems in managing hazards on site. The last part involves the development of the risk assessment system and the implementation of the findings which covers the hazard identification process and risk management for demolition works at UTMKL that suppose to commence on February 2008. However, the project has been postponed to further date that has not been stated up till now. After taking few factors into consideration, the research has been proceed by making an assumption that the traditional method (deconstruction) will be adopted. Hence, the hazard identification process as well as the control measures involve has been identified. The hazard and control measures involve has been stated in risk assessment form that has been developed. The development of the risk assessment form shows that all the objectives for the research has been achieve. The conclusion that can be drawn is the types of hazard that may be arise on site is depends on the activity during the execution of the demolition project.

## ABSTRAK

Tujuan utama kajian ini dijalankan ialah untuk mendapatkan pandangan menyeluruh terhadap situasi yang boleh mendatangkan bahaya semasa projek perobohan dijalankan. Selain itu, ia juga bertujuan untuk mendapatkan maklumat tentang teknik perobohan yang telah dijalankan bagi tujuan penyelidikan akan datang. Kajian ini terbahagi kepada tiga bahagian utama. Bahagian pertama melibatkan kajian kes projek perobohan yang telah dijalankan iaitu Flat Lumba Kuda di Johor Bahru dan Flat Pekeliling di Kuala Lumpur. Hasil daripada kajian menunjukkan bahawa pengurusan risiko dan pelan keselamatan dibuat berdasarkan 'Factories and Machinery Act 1974, Occupational Safety and Health Act 1994' dan berdasarkan pengalaman sedia ada. Bahagian kedua melibatkan perbincangan dengan pakar mengenai cara-cara untuk menangani bahaya di tapak projek. Bahagian terakhir pula melibatkan penghasilan dokumen untuk menilai risiko dan mengaplikasikannya di projek perobohan sebahagian bangunan di UTMKL yang sepatutnya berjalan pada Februari 2008. Walaubagaimanapun, projek tersebut ditangguhkan ke tarikh lain yang belum ditetapkan lagi. Walaubagaimanapun, kajian diteruskan dengan membuat anggapan bahawa teknik perobohan yang digunakan ialah teknik tradisional (Deconstruction). Dengan itu, tanda-tanda bahaya dapat dikenalpasti. Cara-cara mengatasi bahaya dan jenis bahaya diletakkan pada dokumen penilaian risiko. Penghasilan borang penilaian risiko menunjukkan semua objektif kajian tercapai. Sebagai kesimpulan, bahaya di tapak bina dapat dikesan melalui aktiviti yang dijalankan semasa projek tersebut.

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# **CHAPTER 1**

## **INTRODUCTION**

### **1.1 Research Background**

Malaysia has undergone a rapid infrastructure development over the last decade. Considering development will take place from time to time, Malaysia will be overloaded with aging structures that will hinder progress. A perfect solution to encounter this problem is to demolish the existing structures. ACT Safe Demolition Works Third Revised Edition November 2000 states that demolition means the complete or partial dismantling of a building or structure. The specific code of practice is adopted and applies to all premises where demolition of buildings and structures take place in the direction of the effectiveness of demolition process. However, before the demolition works take place, there are few steps involved in the equation within the demolition process.

Most of the demolition practices in Malaysia had little significance in the sense that they did not require specific guide or standards in demolition process. It only relies on the knowledge and experiences of the engineers regarding the matter. There has been no particular procedure and guidelines followed by the engineers to ensure safety at the workplace. According to ACT Safe Demolition Works Third Revised Edition November 2000, the process involved in demolition begins with the decision to demolish. It is then followed by planning and surveying the proposed structure. The engineer then proposes the appropriate demolition method to be included in the

formulation of the work plan. The work plan requires approval from the local authorities before the demolition safety plan can be devised.

Risk management covers most of the parts in the demolition safety plan that if it is neglected, the workplace can be very hazardous. The purpose of demolition safety plan is to identify, assess and to control risks that might occur in the workplace. The basic idea of preparing a demolition safety plan is to plan a systematic approach in order to manage the health and safety at the workplace.

## **1.2 Justification of the Study**

Risk Management is an essential part in a demolition process, which covers all the safe working method for the demolition and removal of all buildings, and structures. It plays an important role to minimize or eliminate accidents occurring at the workplace during the demolition process. Besides that, it also provides information regarding the hazards that may be encounter during demolition works. A demolition practice in Malaysia however does not include the risk management process because Malaysia does not have proper standards on the subject. Unlike other countries like Australia, New Zealand and United Kingdom, specific codes of practice and Acts in demolition process has been shaped as a practical guidance on achieving the standard of health, safety and welfare in order to fulfill the requirement as stated in the *Occupational Health and Safety Act* (“the Act”) and its regulations for particular areas of work. It shows that the demolition process that has been adopted in Malaysia actually does not keeping the persons involved in a safe working environment.

It is important to note that the augmentation of the construction sector in Malaysia has a very direct link towards demolition operations in the country. This is generally true since demolition actually play a significant role in construction industry in order to meet future demands. Hence, numerous workers will involve in the operations and exposed to risks arising from the demolition process. Besides that, it also may involve other civilians nearby. Previous study has proven that there has been

no initiative taken to deal with the problem. The first apparent reason is that there is inadequate or most likely no information on the subject of demolition in Malaysia.

Realizing the importance of risk management in demolition process, a research needs to be conduct to address the problems. However, as an initial step towards the matter, it acquires knowledge on the subject. Therefore, this research will focus on capturing and acquiring information and perspective from the local industry regarding the risk management process in demolition works. Hence, it will provide better information and understanding on the issue.

The research is important to ensure the safe working environment for all workers involved in the subjects. This research might contribute many benefits to our construction industry especially in demolition works in terms of the process that will provide a systematic approach to manage health and safety at the workplace. Hence, zero injuries can be achieved and there is no additional cost meant for accidents.

### **1.3 Aim & Objectives**

This research is aimed at developing an overview as well as assessing the potential hazard of demolition operations in Malaysia. It intends to generate perspective insight into the current state of demolition works which in turn, will be beneficially applied to serve as a solid platform for future research and development. Essentially, the objectives of this research are classified to the following:

1. To identify the hazards associated with the proposed demolition work.
2. To determine control measures to eliminate or reduce the potential risks to workers and other persons affected by the work.
3. To develop a risk management guide for demolition works in Malaysia.

## 1.4 Scope of the Research

For the purpose of this research, the scope of study shall cover these two main areas:

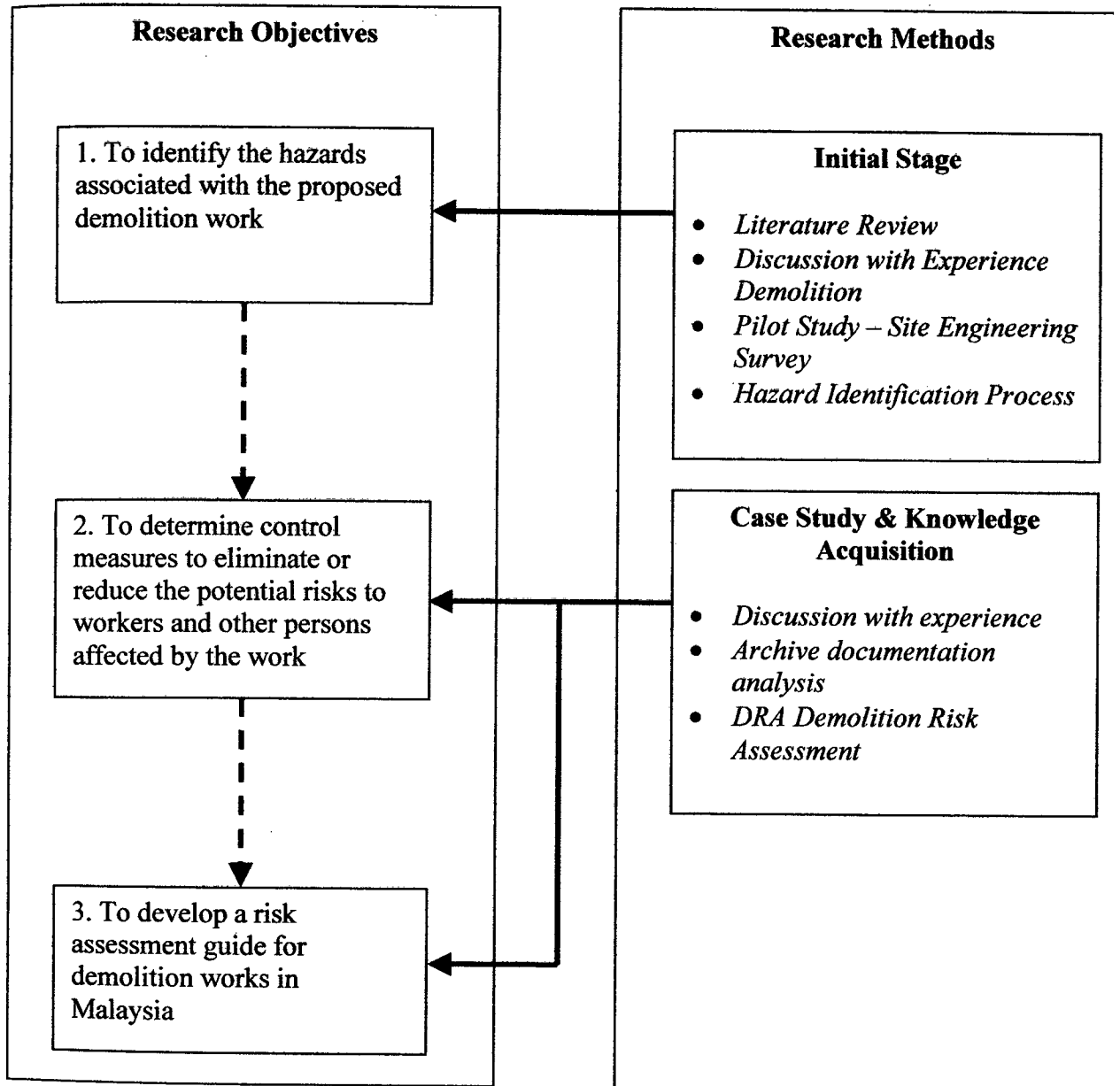
### ✦ *Case Study*

The case study will base on the demolition of Lumba Kuda Flats in Johor Bahru, Pekeliling Flats at Kuala Lumpur and few blocks at UTM *City Campus* in Kuala Lumpur.

### ✦ *Discussion with Experience*

Discussion with Experience Company will be conduct to get the general insight on the specific scope of work.

## 1.5 Research Methodology



**Figure 1.1** Research Objectives and Methods Flowchart



## **CHAPTER 2**

### **LITERATURE REVIEW**

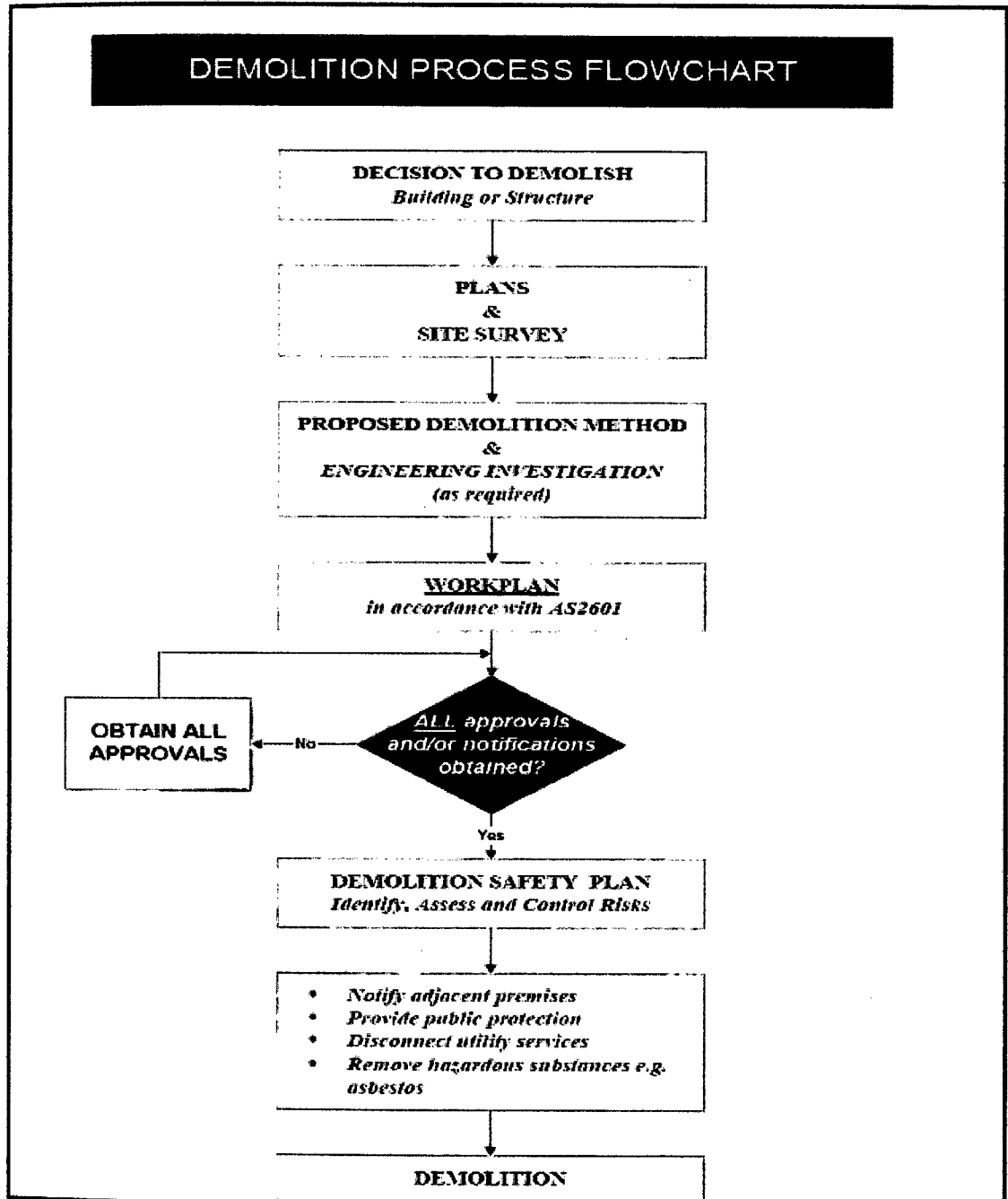
#### **2.1 General**

The evolution of demolition industry in civil engineering has followed closely the developments in structural as a whole. An understanding of structural and material science is desirable to solve any problems regarding demolition. Today, demolition projects undertaken are complex in nature, demanding greater skill, experience and precision than ever before. New innovative advancements have been made to ensure safe operation and work that is more efficient. There are worldwide federations such as the National Association of Demolition Contractors (NADC) and the National Federation of Demolition Contractors (NFDC) that has been established to contribute all the knowledge and skill required.

Due to the awareness of the hazardous surrounding at demolition site, many guides has been prepared to assist people who are responsible for safety and health with detailed procedures to follow in order to identify hazards, assess their risks and implement suitable measures to prevent or reduce the likelihood of their occurrence. These guidelines will investigate what hazards are and how to identify them, explain what safety and health risks are and how to quantify them, and detail strategies for implementing risk controls.

This chapter will highlights the fundamentals of structural demolition as well as the aspects involved in demolition safety plan. The basic knowledge of structural

demolition is required to ensure the effectiveness of demolition process. According to ACT Safe Demolition Work Code of Practice, demolition process can be explained by Figure 2.1.



**Figure 2.1** Activities involve in demolition process.

(ACT Safe Demolition Work Code of Practice, Third Revised Edition, November 2000)

## 2.2 Principles of Structural Demolition

Structural demolition can be defined as:

*“The dismantling, wrecking, pulling down or knocking down of any building or structure or part thereof; but does not include such work of a minor nature which does not involve structural alterations”*

(Department of Labour New Zealand, 1994)

*“Dismantling, razing, destroying or wrecking any building or structure or any part thereof by pre-planned and controlled methods”*

(Code of Practice for Demolition Hong Kong, 1998)

*“The complete or partial dismantling of a building or structure, by pre-planned and controlled methods or procedures”*

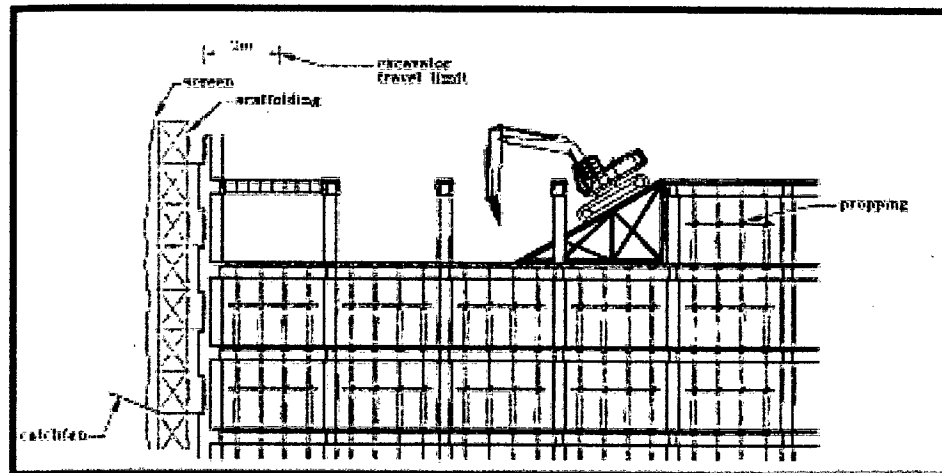
(AS 2601, 2001)

*“Demolition means the complete or partial dismantling of a building or structure. It excludes refurbishment, provided this work does not involve the alteration of existing structural components.”*

(ACT Safe Demolition Work Code of Practice Third Revised Edition, 2000)

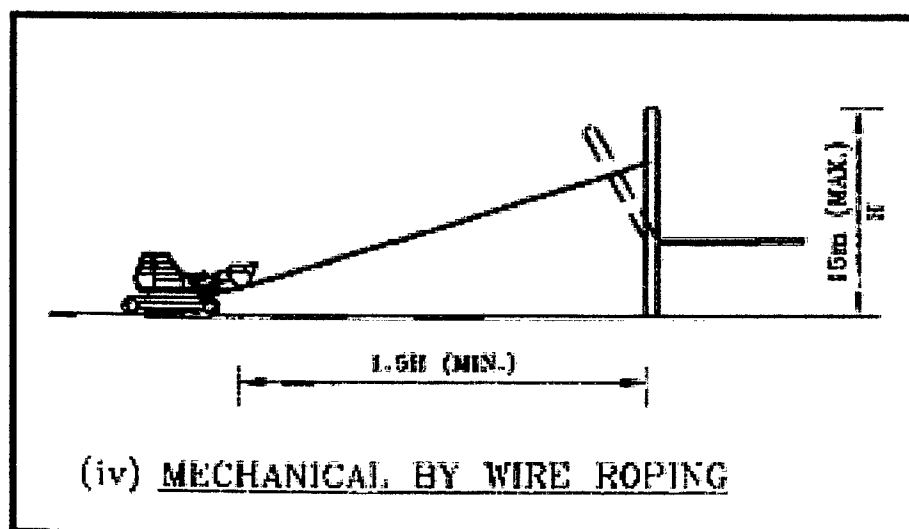
Although the definition varies depends on the sources, it still reflect the same meaning and objective. There are three main categories of structural demolition and they are:

- ✱ **Deconstruction (DCON)** – Deconstruction or Top-down Technique is a technique that proceeds from the roof to ground in a general trend. It is the common technique use in Malaysia to demolished multi-storey structure. The process can be done manually using jackhammer, or breaking away the structure by machine mounted with percussive breaker or other hydraulic attachments.



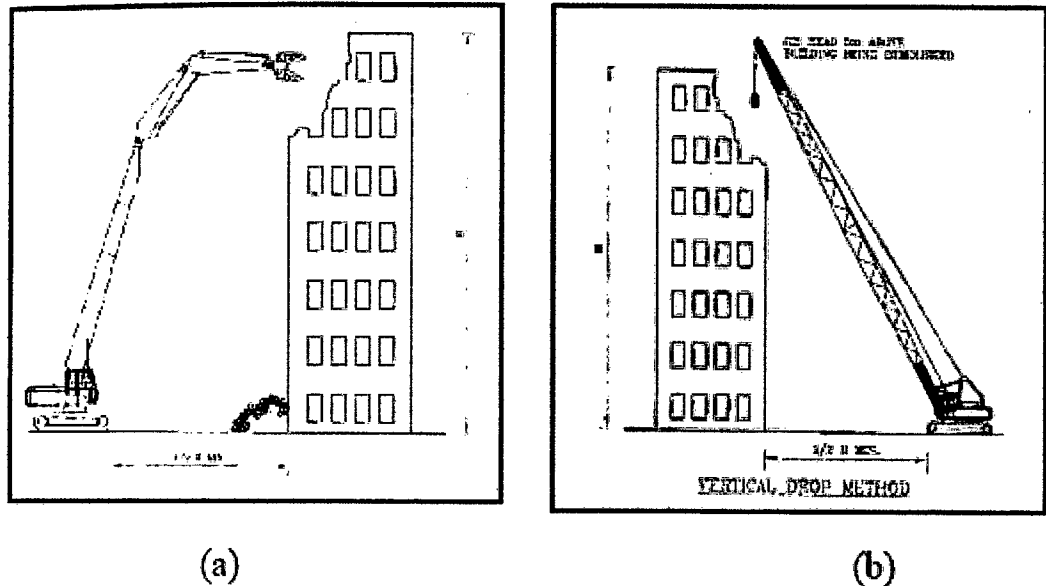
**Figure 2.2** Top-down method using machine mounted with hydraulic attachments.  
(Code of Practice for Demolition, Hong Kong, 1988).

✦ **Deliberate Collapse Mechanisms (DCM)** – considered to be the removal of key structural members to cause complete collapse of the whole or part of the structure. It is usually employed for detached, isolated and reasonably leveled sites where the whole structure is intended to be demolished. Sufficient space should be available to enable equipment and personnel to be relocated to a safe distance. The process can be carried out by using wire rope pulling machine or by using explosive which is also known as the implosion technique.



**Figure 2.3** Deliberate Collapse Mechanisms using wire rope pulling machine.  
(Code of Practice for Demolition, Hong Kong, 1988).

✚ **Progressive Demolition (PD)** – The progressive demolition is the controlled removal of sections of the structure, at the same time retaining the stability of the remainder and avoiding collapse of the whole or part of the structure to be demolished. The process can be done using balling machine or any long reach machine with hydraulic attachment.



**Figure 2.4** (a) Long Reach Machine with various hydraulic attachments,  
(b) Balling Machine.

(Code of Practice for Demolition, Hong Kong, 1988).

### 2.3 Demolition Safety Plan

Demolition safety plan is one of the phase involve in demolition process which covers all the steps acquire to identify, asses an control hazard which might occur at the workplace during the demolition work. It should be developed in consultation with employees and health and safety representative. According to ACT Safe Demolition Works Third Revised Edition November 2000, any demolition activity is forbidden until a demolition safety plan is completed and it must include the following:

#### ↓ **Description of the demolition Workplace**

Which means the demolition safety plan should contain all the information about the site such as the overall height of the structure above ground level and minimum distance between the structures that need to be demolish with each site of the boundary. It also must have all the details about the location of the services such as drainage, sewerage, electricity, gas, water, telecommunication and all other cases such as underground basement and hazardous material that can be found in the workplace.

#### ↓ **Hazard Identification, Risk Assessment, Risk Control and Process Review**

Covers all the steps involve in identifying, asses and control hazard, which might occur in the workplace. It should contain all the information available to make sure that demolition contractor involve aware of the hazards that will arise during the demolition work and the result that may caused by the hazard. Besides that, information about how to minimize the level of risk instructions to report additional hazard must be included. This information is very important to ensure the effectiveness of safe and healthy environment during demolition work.

#### ↓ **Demolition Methods and Work Processes**

Explain all the details about the proposed demolition methods that might be apply to the project including the types of equipment used, the steps involve, methods of handling and disposing hazards material and any other description on the work process.

#### ↓ **Engineering Investigation**

A report which explain all the analysis done by the structural engineer about the structure materials, type of structural system, strength of the structure and every details regarding the structure.

#### **4. Induction and Training**

Section 27(2) (d) of the Occupational Health and Safety Act 1989 UK highlight that the employers should provide training to enable all the employees to perform their work in manner that is safe and without risk to health. Therefore, demolition safety plan should include all the details about the training involve for the workers and record on the activities.

#### **4. Emergency procedures**

Demolition safety plan should also highlight the information for first aid requirement and prompt medical attention in case of serious injury. The location of the nearest medical facility should be stated as well as the contact numbers and person in charge in the situation.

### **2.3.1 Hazard Identification**

A hazard is anything with the potential to harm life, health or property. Hazard identification is the process of identifying all hazards in the workplace. According to ACT Safe Demolition Works Third Revised Edition November 2000, identification of hazards should include those that exist at the workplace before work begins. In order to understand what hazard identification involves, an understanding about the nature of hazards must be achieved. Hazards are the main cause of occupational health and safety problems at workplace. Therefore, finding ways of eliminating hazards or controlling the associated risks is the best way to minimize workplace injury and illness.

Hazard identification involves the systematic approach or investigation of all potential hazard sources and the recording of hazards identified. In other words, it means identifying all of the possible ways in which people may be harmed caused by the activities. A systematic approach should be applied in identifying the hazards at the workplace to ensure the effectiveness of the process. Stated in the ACT Safe

Demolition Works Third Revised Edition November 2000, methods of identifying hazards include:

- ✦ Inspections of the demolition site and structure, plant and equipment, and direct observation of work processes.
- ✦ Consultation with workers, who are usually aware of what can go wrong and why, based on their experience with a job.
- ✦ Consultation with specialist practitioners and representatives of industry associations, unions and government bodies, for advice and information on health and safety matters relevant to demolition work.
- ✦ Analysis of workplace injury and incident records on demolition and construction sites, to identify where and how injuries have previously occurred.

It is important to notice that hazards can arise in many different ways and can take various forms which may result may result unnecessary costs and human suffering. Hence, hazard identification process must be properly done to achieve zero injuries.

### **2.3.2 Risk Assessment**

Risk is the potential outcome of a hazard that may arise in the workplace. It means risk is the possibility of injury, illness, damage or loss occurring because of hazard. Risk assessment means the process of assessing all of the risks associated with each of the hazards identified during the hazard identification process. When hazards have been identified, the next step is to assess in terms of their potential to cause injury or illness to anyone at or near the workplace. According to ACT Safe Demolition Works Third Revised Edition November 2000, factors that need to be considering when determining risk are: