

HEALTH AND SAFETY IN REFURBISHMENT PROJECTS INVOLVING  
DEMOLITION WORK

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To my beloved sister and our late Iliya

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No one walks alone on the journey of life. Just where you start to thank those that joined you, walked beside you, and helped you along the way continuously urged me to write a project. So at last, here it is. So, perhaps this project and its pages will be seen as "thanks" to you who have helped make my life what is today. Much of what I have learned over the years came as the results of continuous pure support of my father and mother. I also have to express my gratitude to my supervisor Associate Professor Dr. Arham Abdullah, whom I have had the pleasure of being trained by on this project. I also need to thank my wonderful sister, Ms. Mahboubeh Rakhshanifar, who inspired and assist me in developing the research. I also need to thank JSC Demolition Company, an amazing organization for their fulfilling assistance. I also thank Mr. Mohammad Mahdi Hosseini for his specific guidance and assistance on management issues. Finally, I wish to thank Noorashikin Abdul Rahman for her sincere assistance through data collection.

And to God, who made all things possible.

## ABSTRAK

Pengubahsuaian adalah sebarang penaiktarafan, perubahan, perubahan dalam status semasa sesebuah bangunan bagi meningkatkan persembahan prestasi dan keberkesanan sesuatu struktur. Projek-projek pengubahsuaian melibatkan perubahan struktur, pengekalan dan perobohan sebahagian di mana melibatkan beberapa risiko yang berbeza. Adalah penting bagi menimbang dan mengutamakan isu-isu keselamatan dan membangunkan strategi-strategi pengurusan yang boleh diaplikasikan bagi amalan pengubahsuaian sebagaimana peningkatan dalam jumlah projek – projek pengubahsuaian dan peningkatan kadar kematian yang berpunca daripada kerja pengubahsuaian. Peningkatan dalam jumlah kemalangan boleh memberikan kesan kepada kumpulan projek dalam banyak aspek. Kerugian kewangan dan penangguhan dalam menyempurnakan kerja, akibat tipikal yang berpunca daripada aktiviti-aktiviti pengubahsuaian. Bagi kes-kes yang kritikal, imej kontraktor, para pelanggan, dan pengurusan secara umumnya, akan tercalar. Oleh itu, pembekalan senarai semak keselamatan dan kesihatan membantu mengurangkan ketidakpatuhan dalam peraturan-peraturan berkaitan keselamatan dan kesihatan dan meningkatkan aliran komunikasi dalam projek-projek ubahsuai. Lanjutan itu, senarai semak ini akan digunakan sebagai asas bagi latihan keselamatan dan kesihatan bagi para pekerja. Untuk mencapai target ini, teknik perobohan, kaedah dan laporan kemalangan semasa projek pengubahsuaian dikenalpasti dan dikaji. Selain itu, temubual semi-struktur dikendalikan bagi membekalkan senarai punca bahaya yang berlaku dalam tapak dan langkah-langkah berjaga yang sesuai boleh diaplikasikan dalam projek bagi mengelakkan kemalangan-kemalangan dalam kawasan kerja. Keputusan yang diperolehi diorganisasikan dalam senarai semak aktiviti-aktiviti, langkah-langkah berjaga dan cadangan-cadangan.

## **ABSTRACT**

Refurbishment is any upgrade, alteration, modification in the current status of the building to improve performance and efficiency of the structure. Refurbishment projects involve structural alteration, retention and partial demolition which merely coincide with different risks. The importance of considering safety issues and developing management strategies applicable for refurbishment practice arise as a result of increase in the total number of the refurbishment projects and growth of the fatality rate caused by refurbishment work. Increase in the number of accidents may affect project team in many aspects. Financial losses and delay in the completion of work are the typical consequences caused by refurbishment activities. On the critical cases, the public image of the contractors, clients, and management team as general, will be damaged. Therefore, providing a safety and health check list may assist to reduce incompliance with health and safety regulations and to improve communication flow in refurbishment projects. Further, this check list may be used as a basis for the health and safety trainings for the workers. To achieve this target, demolition techniques, methods and accident reports on the refurbishment project has been identified and reviewed. Next, a semi-structured interviewed was conducted to provide a list of common hazards occurring in the site and appropriate precautions that can be applied in the project to prevent accidents in working place. The obtained result was organized in a check list of activities, preventive actions and recommendations.

## TABLE OF CONTENTS

CHAPTER	TITLE	PAGE
	<b>TITLE I</b>	
	<b>DECLARATION II</b>	
	<b>DEDICATION III</b>	
	<b>ACKNOWLEDGEMENT</b>	<b>IV</b>
	<b>ABSTRAK V</b>	
	<b>ABSTRACT VI</b>	
	<b>TABLE OF CONTENTS</b>	<b>VII</b>
	<b>LIST OF TABLES</b>	<b>XIII</b>
	<b>LIST OF FIGURES</b>	<b>XIV</b>
	<b>LIST OF ABBREVIATIONS</b>	<b>XV</b>
<b>1</b>	<b>INTRODUCTION</b>	<b>ERROR! BOOKMARK NOT DEFINED.</b>
	1.1Background	Error! Bookmark not defined.
	1.2Problem Statement	Error! Bookmark not defined.
	1.3ResearchQuestions	Error! Bookmark not defined.
	1.4Aim of the Study	Error! Bookmark not defined.
	1.5The Objective of the Study	Error! Bookmark not defined.
	1.6Scope of the Study	Error! Bookmark not defined.
	1.7Methodology	Error! Bookmark not defined.
	1.8 Research Outline	Error! Bookmark not defined.

## 2 REFURBISHMENT, DEMOLITION AND SAFETY FACTORS **ERROR!**

BOOKMARK NOT DEFINED.

2.1 General **Error! Bookmark not defined.**

2.1.1 Definitions **Error! Bookmark not defined.**

2.1.2 Refurbishment and Partial Demolition **Error!  
Bookmark not defined.**

2.2 Demolition Methods **Error! Bookmark not defined.**

2.3 Demolition Technique **Error! Bookmark not defined.**

2.3.1 General **Error! Bookmark not defined.**

2.3.2 Types of Demolition Technique **Error! Bookmark not  
defined.**

2.3.2.1 Diamond Sawing and Cutting **Error!  
Bookmark not defined.**

2.3.2.2 Hydro-demolition **Error! Bookmark not  
defined.**

2.3.2.3 Balling **Error! Bookmark not defined.**

2.3.2.4 Top-down manual with jack hammer or  
pneumatic hammer **Error! Bookmark not  
defined.**

2.3.2.5 Thermal lance **Error! Bookmark not defined.**

2.3.2.6 Wire saw cutting **Error! Bookmark not  
defined.**

2.3.2.7 Top-down by machine hydraulic crusher  
**Error! Bookmark not defined.**

2.3.2.8 Drilling **Error! Bookmark not defined.**

2.3.2.9 Top-down with machine percussive breaker  
**Error! Bookmark not defined.**

2.3.3 Selection criteria for demolition techniques **Error!  
Bookmark not defined.**

- 2.3.3.1 Health and safety **Error! Bookmark not defined.**
- 2.3.3.2 Stability of the Structure **Error! Bookmark not defined.**
- 2.3.3.3 Location and Accessibility **Error! Bookmark not defined.**
- 2.3.3.4 Presence of Hazardous Material **Error! Bookmark not defined.**
- 2.3.3.5 Environmental Considerations **Error! Bookmark not defined.**
- 2.3.3.6 Shape and Size of the Structure **Error! Bookmark not defined.**
- 2.3.3.7 Client Specification **Error! Bookmark not defined.**
- 2.3.3.8 Structural Engineers Approval **Error! Bookmark not defined.**
- 2.3.3.9 Time Constraints **Error! Bookmark not defined.**
- 2.3.3.10 Extension of demolition **Error! Bookmark not defined.**
- 2.3.3.11 Financial Constraint **Error! Bookmark not defined.**
- 2.3.3.12 Recycling Considerations **Error! Bookmark not defined.**
- 2.3.3.13 Transportation Considerations **Error! Bookmark not defined.**
- 2.3.3.14 Availability of Plant and Equipment **Error! Bookmark not defined.**
- 2.4 Safety and Health Management in Demolition **Error!**  
Bookmark not defined.



- 2.4.1 General **Error! Bookmark not defined.**
- 2.4.2 Risk Assessment and Safety Factors **Error! Bookmark not defined.**
- 2.4.2.1 Hazard Identification **Error! Bookmark not defined.**
- 2.4.2.2 Risk analysis **Error! Bookmark not defined.**
- 2.4.2.3 Risk Control 31
- 2.5 Investigating Management Strategies in Refurbishment Projects **Error! Bookmark not defined.**
- 2.5.1 The Selection of an Appropriate and Suitable Procurement Route **Error! Bookmark not defined.**
- 2.5.2 Demolition Design and Planning **Error! Bookmark not defined.**
- 2.5.2.1 General **Error! Bookmark not defined.**
- 2.5.2.2 Site Location **Error! Bookmark not defined.**
- 2.5.2.3 Structural Considerations **Error! Bookmark not defined.**
- 2.5.2.4 Utilities Location **Error! Bookmark not defined.**
- 2.5.2.5 Demolition Schedule **Error! Bookmark not defined.**
- 2.5.2.6 Testing and Removal of Hazardous Material **Error! Bookmark not defined.**
- 2.5.2.7 Safety Measures **Error! Bookmark not defined.**
- 2.5.2.8 Debris Handling **Error! Bookmark not defined.**
- 2.5.2.9 Stability Report with Calculations **Error! Bookmark not defined.**

2.5.2.10 Consent Application **Error! Bookmark not defined.**

2.5.3 Selection and Use of Plant and Equipment **Error! Bookmark not defined.**

2.5.4 Workforce Pre-qualification, Selection and Supervision  
**Error! Bookmark not defined.**

2.5.5 Communication of Project Requirements and H & S Information **Error! Bookmark not defined.**

2.6 Reviewing of Refurbishment Sites in the UK and Italy **Error! Bookmark not defined.**

2.7 Conclusion **Error! Bookmark not defined.**

### **3 METHODOLOGY AND CASE STUDY **Error! Bookmark not defined.****

3.1 General **Error! Bookmark not defined.**

3.2 Conceptual Design **Error! Bookmark not defined.**

3.2.1 General **Error! Bookmark not defined.**

3.2.2 Qualitative Interview **Error! Bookmark not defined.**

3.2.3 Different Criteria for Selecting an Appropriate Case study **Error! Bookmark not defined.**

3.3 Case Study **Error! Bookmark not defined.**

3.3.1 Introduction to the Problem **Error! Bookmark not defined.**

3.3.2 Background **Error! Bookmark not defined.**

3.3.2.1 Malaysia **Error! Bookmark not defined.**

3.3.2.2 Johor Bahru, City Centre, City Square shopping Complex **Error! Bookmark not defined.**

3.3.3 Current Practice in the Site **Error! Bookmark not defined.**

3.4 Policies **Error! Bookmark not defined.**

3.4.1 Hoarding and Covered Walkway **Error! Bookmark not defined.**

3.4.2 Scaffoldings and Screen Covers **Error! Bookmark not defined.**

3.4.3 Catch fan **Error! Bookmark not defined.**

3.4.4 Temporary Supports **Error! Bookmark not defined.**

3.4.5 Protection of Properties **Error! Bookmark not defined.**

3.4.6 Traffic Protection **Error! Bookmark not defined.**

3.4.7 Special Safety Consideration **Error! Bookmark not defined.**

3.4.8 Equipment Maintenance **Error! Bookmark not defined.**

3.4.9 Electrical Safety **Error! Bookmark not defined.**

3.4.10 Fire **Error! Bookmark not defined.**

3.4.11 Occupational Health **Error! Bookmark not defined.**

3.4.12 Emergency Exit Requirements **Error! Bookmark not defined.**

3.4.13 Vibration **Error! Bookmark not defined.**

3.4.14 Environmental Precautions **Error! Bookmark not defined.**

3.5 Conclusion **Error! Bookmark not defined.**

## **4 RESULTS AND DISCUSSION** **Error! Bookmark not defined.**

4.1 General **Error! Bookmark not defined.**

4.2 Study of Management Strategies **Error! Bookmark not defined.**

- 4.2.1 Traditional Procurement System and H&S Management Strategies on Refurbishment Projects **Error! Bookmark not defined.**
- 4.2.2 Demolition Design and Planning **Error! Bookmark not defined.**
- 4.2.3 Selection and Use of Plant and Equipment **Error! Bookmark not defined.**
- 4.2.4 Workforce Training **Error! Bookmark not defined.**
- 4.2.5 Communication of Project Requirements and H&S Information **Error! Bookmark not defined.**
- 4.3 Roles and responsibilities of refurbishment figures **Error! Bookmark not defined.**
  - 4.3.1 The Client **Error! Bookmark not defined.**
  - 4.3.2 The Site Supervisor **Error! Bookmark not defined.**
  - 4.3.3 The Architect **Error! Bookmark not defined.**
  - 4.3.4 The Structural Engineer **Error! Bookmark not defined.**
  - 4.3.5 The Contractor **Error! Bookmark not defined.**
  - 4.3.6 The Demolition Contractor **Error! Bookmark not defined.**
  - 4.3.7 Temporary structure/scaffolding coordinator **Error! Bookmark not defined.**
  - 4.3.8 Workers **Error! Bookmark not defined.**
  - 4.3.9 Supervision of Work During and After Demolition **Error! Bookmark not defined.**
- 4.4 The Health and Safety Checklist **Error! Bookmark not defined.**
  - 4.4.1 Selection of Suitable Procurement Route **Error! Bookmark not defined.**

4.4.2	Demolition Design and Planning	<b>Error!</b>	<b>Bookmark not defined.</b>
4.4.3	Selection and Use of Plant and Equipment	<b>Error!</b>	<b>Bookmark not defined.</b>
4.4.4	Workforce Training and Supervision	<b>Error!</b>	<b>Bookmark not defined.</b>
4.5	Conclusion	91	
<b>5</b>	<b>SUMARY AND CONCLUSION</b>	<b>93</b>	
5.1	General	93	
5.2	Conclusion	93	
	REFERENCES	96	
	APANDIX A	101	
	APANDIX B	104	

**LIST OF TABLES**

<b>TABLE NO</b>	<b>TITLE</b>	<b>PAGE</b>
1	Occurrences of structural collapses during construction in UK	<b>Error!</b>
	<b>Bookmark not defined.</b>	
2	Identification of Key Safety factors during demolition phases	<b>Error!</b>
	<b>Bookmark not defined.</b>	
3	Probability Rating	<b>Error! Bookmark not defined.</b>
4	Severity Ratings	<b>Error! Bookmark not defined.</b>
5	Range of risk control	<b>Error! Bookmark not defined.</b>
6	Respondents in Categories	<b>Error! Bookmark not defined.</b>
7	Common Hazards in Refurbishment	<b>Error! Bookmark not defined.</b>

## LIST OF FIGURES

FIGURE NO	TITLE	PAGE
1	Construction Worker Fatalities by Site Activities	<b>Error! Bookmark not defined.</b>
2	Demolition Techniques and Type of Structure	<b>Error! Bookmark not defined.</b>
3	A model for demolition technique selection	<b>Error! Bookmark not defined.</b>
4	Demolition Process	<b>Error! Bookmark not defined.</b>
5	Risk Analysis Grids	<b>Error! Bookmark not defined.</b>
6	Communication in Traditional System	<b>Error! Bookmark not defined.</b>
7	Types of construction accidents in Malaysia during 1996-2005	<b>Error! Bookmark not defined.</b>
8	Demolition and Propping System in JB City Square Complex	<b>Error! Bookmark not defined.</b>

**LIST OF ABBREVIATIONS**

BEPCON	MS
BS	NIOSH
CDM	
CIOB	
CIRIA	Building Electrical and Plumbing Control
DBKL	British Standard
DOE	Construction Design and Management
DOSH	Chartered Institute of Building
EIA	Construction Industry Research and Information Association
FMA	Dewan Bandaraya Kuala Lumpur
GPSHCS	Department of Energy
H&S	Department of Safety and health
HIRARC	Environmental Impact Assessment
HSE	Factories and Machineries act
ILO	Guidelines for Public Safety and Health in Construction Site
M&E	Health and Safety



Hazard	
Identification, Risk Assessment, Risk control	ONS OSH OSHA
Health and Safety Executive	PDRM PME PPE
International Labor Organization	R&M TIA
Mechanical and Electrical	Office for National Statistics Occupational Safety and Health Occupational Safety and Health Administration
Malaysian Standard	Jawatan Kosong Polis DiRaja Malaysia
National Institute of Safety and Health	Powered Mechanical Equipment Personal Protective Equipment Repair and Maintenance Traffic Impact Assessment

## **CHAPTER 1**

### **INTRODUCTION**

#### **1.1 Background**

As conservation and reuse enter the mainstream of practice, young engineers recover that little or nothing in their education has prepared them for this revolution. The pas has caught up with us without our recognising it. (Bowles & Thorne, 2008)As a result of sustainable development, the importance of refurbishment practices becomes more tangible because, in nature, refurbishment adhere the resource preservation and prevent carbon emission. Refurbishment is defined as adaptation, extension, improvement and structural alteration of an existing building (Charles O. Egbu, Young, & Torrance, 1996) to permit its re-use and meet functional criteria equivalent to those required for new building. Refurbishment work is less well-planned and more difficult to control than new-build (Charles O. Egbu, 1996).

During last 2 decades, refurbishment and upgrading projects comprise almost half (45 %) of the construction work in UK(ONS, 2009) and during the last decade a significant increase in the amount of refurbishment project was reported in Malaysia as well. In comparison with demolition and reconstruction, refurbishment projects are most cost effective and operative. On the other hand, refurbishment accounts for a substantial proportion of injuries and fatal accidents. 40.6% of construction fatalities as provided by the (HSE, 1988).

As reported by HSE on 12 August 2005, SJB Demolition & Ground works began demolition of a two-storey garage building in Brent, North London, while three workers were inside the ground floor area. As rubble began to fall down the inside stairwell, one of the workers fled through the open front of the building and was hit by the collapsing front wall. He was partly buried in debris and sustained injuries to his neck, shoulder and ribs. An HSE investigation revealed SJB had not checked the area or issued any warning before beginning the work (HSE, 2005).

Similar case happened in Malaysia on 28<sup>th</sup> May 2009. Jaya supermarket collapsed during demolition work. Seven workers died; while three more were injured during the accident and 69 residents of 12 houses in the vicinity of the supermarket were evacuated in order to provide buffer zone for further demolition work (DOSH, 2009). Therefore, refurbishment works are risk intensive and can be considered as one of the most dangerous activities among construction works and need strategic safety management.

## **1.2 Problem Statement**

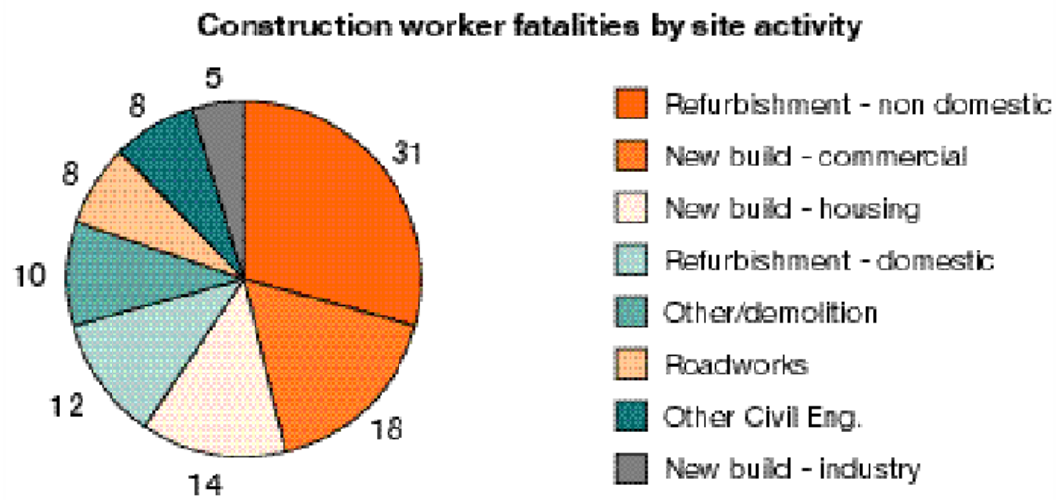
Construction industry, annually, suffer a huge amount of damages due to construction accidents caused by non-efficient risk management. Many workers injured reversibly or irreversibly and many contractors and clients lose in terms of compensation costs and reputation consequently.

Fatality rate shows an irregular pattern which is mainly caused by unstable development of construction industry and economic status of countries. Additionally, lack of safety awareness among workers, lack of commitment by employers to implement measures to improve occupational safety and health contributed towards the increasing number of accidents. A study on fatal accident shows that 75% of fatal accidents are caused by lack of effective management practice (HSE, 1988).

Refurbishment projects with a high rate of risk, lack safety consideration and recommendation during planning, design and execution phase. There is evidence that the construction industry lacks effective management systems to cope with refurbishment safety risks and hazards (Charles O. Egbu, et al., 1996) although it is widely acknowledged that refurbishment projects are complex, risky and uncertain (Charles O Egbu, 1994; Quah, 1992).

Unfortunately, no official statistics exist on the current proportion of refurbishment work in Malaysia. The R & M sector (the UK repair and maintenance sector), since 1990, has accounted for more than 40% of the total UK construction output and accounts for about 43% of the total number of fatal accidents in building and civil engineering industry in UK (HSE, 2002).

Common hazards which could result in fatal accidents in demolition and refurbishment work include falling debris, premature collapse of element/structures, dust and fumes, asbestos, noise and vibration, and electric shock (Hughes & Ferrett, 2008).



**Figure 1: Construction Worker Fatalities by Site Activities**

Source: (HSE, 2004)

In comparison with the total demolition, partial demolition which is the key element on refurbishment projects requires a larger number of workers due to the manual activities. Unfortunately, partial demolition shows a higher potential of fatal accidents occurrence compared to demolition work. Social impacts of construction accidents, on the other hand, are not well specified however, in some cases, it may involve people from different walks. This will highlight the importance of the supervision and monitoring of the safety factors in refurbishment sites.

Therefore, this study managed to identify accident prevention procedures during refurbishment works in order to avoid fatal and serious injuries, and economic loss. Hence, the need for hazard identification and control measures in refurbishment projects is highlighted. Therefore, the organizations and individuals involved in refurbishment projects, from worker and non-worker victims to the government would ensure the safer completion of refurbishment projects which is the focus of the current project.

### **1.3 Research Questions**

Before commencement of work in developing a safety management framework for refurbishment project we should consider following questions:

1. What are existing hazards in refurbishment sites and projects;
2. How serious or how frequent each hazard is and how it could affect the work process;
3. What are the current practices and criteria for selecting appropriate methods;
4. What are the most important consideration and recommendation in these projects in order to avoid incidents in the sites.

### **1.4 Aim of the Study**

This study is managed to specify the efficient management strategies by providing a safety and health framework for refurbishment projects in order to minimize the number of accidents and improve health and safety status of the refurbishment site.

### **1.5 The Objective of the Study**

As a result of accurate inspection and supervision of work, protective measures can be applied by the management team and safety committee which is assigned by the head management officer. Therefore, providing a check list of safety measures can be an effective tool to monitor the sequence of project. The specific objectives of this research are:

1. To identify hazards caused by the nature of refurbishment project;
2. To identify common accidents happen during refurbishment work;
3. To develop a safety check list for refurbishment projects to manage safety and health in these projects.

## **1.6 Scope of the Study**

The scope of work mainly focuses on identifying hazards and existing risk in refurbishment project in Malaysia in order to provide a framework for the constructors to comply with to avoid accidents and incidents in working sites. The proposed refurbishment project to be investigated is City Square Shopping Complex in Johor Bahru, Malaysia. It is projected to demolish Reinforced Concrete beams, slabs, and parapet walls in Level 5, 6 and 7 of this building.

The typologies of the selected case study covered different types of refurbishment sites as office buildings and commercial areas. Therefore the selected case study present a comprehensive range of refurbishment safety issues that allowed the development of all the findings and considerations of the project.

## **1.7 Methodology**

To achieve forgoing targets a combination of methods is proposed and utilized. Firstly, existing literature on health and safety in refurbishment projects shall be reviewed. Next, review of the current statistics on the accident and, where possible, incident occurred during demolition work is suggested. Finally, to establish end user requirement, semi structured interviews were conducted within industry

practitioners including structural engineer, project manager, site supervisor, demolition contractor, contractors, workers and clients.

## **1.8 Research Outline**

This study conducted the research at University Technology Malaysia on ‘Health and Safety in Refurbishment Projects Involving Demolition Work’. The first chapter of research illustrates the main contents of the project including the research background, objectives and methodology and the case study that has been investigated.

The next chapter discusses the key safety factors identified for refurbishment sites involving demolition activities. Recommendations related to key issues to be considered for the implementation of safety management strategies in refurbishment projects is also documented. The research work has highlighted the importance of proactive involvement of all the key functionaries for a better safety management of the whole refurbishment process. The report documents the key responsibilities for all the figures identified in the refurbishment process.

Chapter 3 of the research justify the applied method to achieve the objectives of the current research and to fulfil research questions. A good example of the practice was documented to direct the application of the method in the real life issue with regards to the prerequisite criteria for selection of the case study.

In chapter 4, the results of the site investigation and interviews is developed followed by the discussion on the archived results and provided recommendation presented by the respondents. The check list has been depicted at the end of this chapter.



Conclusion and further studies have been covered in the last chapter. The report concludes with recommendations for further research and a reliable safety check list for the implementation of demolition incurred by refurbishment projects based on the results achieved from this project.

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