# HIDDEN COST IN BUILDING CONSERVATION WORKS

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**UNIVERSITI SAINS MALAYSIA**

**2011**

# HIDDEN COST IN BUILDING CONSERVATION WORKS

**by**

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**Thesis submitted in fulfillment of the requirements**
**for the degree of**
**Master of Science**

**November 2011**

# KOS TIDAK KETARA DALAM KERJA PEMULIHARAAN BANGUNAN

**oleh**

**WEE LI WOON**

**Thesis yang diserahkan untuk**
**memenuhi keperluan bagi**
**Ijazah Sarjana Sains**

**November 2011**

## ACKNOWLEDGEMENT

This thesis is never an individual effort, but with the combined efforts and guidance from lecturers and seniors, directly or indirectly. Here, I wish to express my greatest appreciation to my thesis's supervisor Associate Professor Lim Yoke Mui for her guidance throughout the process of writing this thesis. Special thanks is dedicated to seniors who have helped me in collecting data and giving me directions in doing the research. With all the guidance and advice given from supervisor and research seniors, I am able to complete my thesis on time. Their encouragement and assistance have led me to work harder to strive for better achievement in this research.

I also wish to express my gratitude to my family and friends for their support and care. Last but not least, I wish to thank all those who have helped me in completing my thesis. Thank you.

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| | |
|---|---|
| CIDB | Construction Industry Development Board |
| HABS | Historical Architectural Building Survey |
| ICOMOS | International Council on Monuments and Sites |
| JWN | Jabatan Warisan Negara |
| PHT | Penang Heritage Trust |
| QS | Quantity Surveyor |
| UNESCO | United Nations Educational, Scientific and Cultural Organization |

**KOS TIDAK KETARA DALAM KERJA PEMULIHARAAN BANGUNAN**

## ABSTRAK

Projek pemuliharaan bangunan lama seringkali dikaitkan dengan pemuliharaan kos yang tinggi dan masa yang panjang di mana sebahagiannya adalah disebabkan oleh ketidakpastian terhadap kerja-kerja yang perlu dijalankan untuk memelihara bangunan lama. Selain itu, jurukur bahan yang tidak biasa dengan kerja pemuliharaan bangunan sering menghadapi kesukaran dalam mengira kos pemuliharaan bangunan lama dengan tepat. Menyedari kerumitan yang dihadapi oleh jurukur bahan dalam mengira anggaran kos yang tepat, satu kajian telah dijalankan untuk mengenal pasti kos yang tidak ketara dalam kerja pemuliharaan bangunan, khususnya kerja-kerja yang menyebabkan peningkatan kos pada projek serta faktok-faktor yang menyumbang kepada peningkatan kos dalam kerja pemuliharaan bangunan lama. Seramai 16 responden yang telah terlibat dalam kerja pemuliharaan bangunan lama di Malaysia telah dipilih untuk tujuan kajian ini dengan menggunakan soal selidik secara pos. Sebanyak 30 item kerja yang digunakan dalam kerja pemuliharaan bagunan lama telah dikenal pasti melalui soal selidik, di mana item-item kerja ini dibahagikan kepada empat kategori utama, iaitu 'Penyelidikan dan Dokumentasi', 'Kajian Sains', 'Ujian Makmal' dan 'Kerja-kerja Sementara'. Bahan-bahan kerja pembangunan seperti '*Carbonation Test*', '*NIPGAT Test'*, '*Petrography Test'*, and '*Covermeter Survey'* didapati mempunyai nilai Indeks Relatif yang tinggi. Selain itu, sebanyak 32 faktor turut dikaji bagi menentukan punca-punca kos tak ketara dalam kerja pemuliharaan bangunan. Faktor-faktor utama yang mengakibatkan peningkatan kos yang tidak ketara dalam pemuliharaan bangunan lama termasuklah 'kekurangan kepakaran jurukur bahan dalam kerja-kerja

pemuliharaan' dan 'kurang komunikasi antara perunding bangunan’. Kajian ini mencadangkan jurukur bahan untuk merujuk bahan-bahan bangunan yang dikenalpasti dalam kajian ini sebagai rujukan apabila menyediakan kos anggaran bagi kerja-kerja pemuliharaan.

**HIDDEN COST IN BUILDING CONSERVATION WORKS**

## ABSTRACT

More often than not, building conservation projects are usually completed with high cost and high time variances, which, in part is due to the uncertainty in actual work needed to conserve the building. Also, difficulty exists for cost estimators who are unfamiliar with building conservation works to estimate accurately. Realising the predicament in producing an accurate estimate, a study was conducted to identify the hidden costs of building conservation works, specifically the work items that contribute to such hidden cost and the factors affecting the cost overruns. A total of 16 respondents who have been involved in building conservation projects in Malaysia are surveyed using postal questionnaire. A total of thirty (30) work items that are specific to building conservation works are identified from the survey. Based on the results, these 30 special work items are grouped into four main categories, namely Research and Documentation, Scientific Studies, Laboratory Tests and Temporary Works. From the survey, work items such as 'Carbonation Test', 'NIPGAT Test', 'Petrography Test', and 'Covermeter Survey' are found to have the highest Relative Index value. Additionally, a total of 32 factors are also surveyed to detect the determinants of hidden costs in building conservation works. Dominant variables which are causing hidden costs include 'lack of estimator's expertise in conservation work' and 'lack of communication between consultants'. This study concludes with a list of work items encountered in building conservation works for quantity surveyor's reference to prepare the cost estimate in future.

# CHAPTER 1

# INTRODUCTION

## 1.1 Background

Building conservation relates specifically to the process of repair, maintenance and restoration of historic buildings (Fielden, 1996; Insall, 1972) which aims to prolong a building's life and functions. In Malaysia, building conservation practice is relatively new (Kamal *et.* Al, 2008) compared to some other countries. Under the Antiquities Act 1976, a historic building or monument that aged at least 100 years old, can be listed or gazetted by the Government through the Museum Department to give protection and encouragement for preservation and conservation (Ahmad, 1994a). However, this Act is replaced with the National Heritage Act 2005 (NHA 2005). This Act provides for the conservation and preservation of natural heritage, tangible and intangible cultural heritage, underwater cultural heritage, treasure trove and for related matters. With the listing of George Town and Malacca as UNESCO's World Heritage Sites in July 2008, the efforts of conservation of historic buildings in Malaysia are expected to receive more attention than ever before.

For building conservation work, the cost to conserve heritage buildings is determined by the range of defective works. The more defective works encountered in buildings, the higher the cost needed to conserve the buildings. However, due to the uncertainty in conservation works (Reyers and Mansfield, 2001), conservation projects are mostly completed with high cost and time variances (Ali *et al*, 2009). Hence, conservation projects commonly require consultants to have additional knowledge in the methods of construction for conservation works to ensure lower cost and time variances. For example, a quantity surveyor (QS) needs to have a good

understanding of the conservation work process in order to forecast the cost budget for conservation works. If a QS does not possess certain knowledge of conservation works, he might tend to miss out some works items that are only encountered in building conservation works, when estimating the cost budget for a particular conservation project.

Commonly, in typical construction works, cost estimation is an initial step before an execution of construction work on site. A quantity surveyor (QS) firstly estimates the cost budget for a proposed project using the various estimating method (Ashworth and Hogg, 2007). While it may be possible to complete a project within the forecast budget in new-build work, the situation is very different in conservation works (Mansfield, 2009). For conservation works, the sequence of works commence from the top of the roof to the foundations of buildings, which is in reverse with new-built work. The current format of cost estimate method is designed for new-built buildings only. Thus, a QS would have to adapt the current format of cost estimate method to calculate the budget for conservation works. While this method is not incorrect, however, there are some special work items that are only encountered in building conservation works, which are not included in the format of the standard form of measurement.

Other than the differences in the work sequence, there are also certain special work items that are used only in conservation projects but not in new-build projects. The recognition of these work items provides a difficulty to quantity surveyors when trying to provide clients with preliminary estimates of out-turn costs (Mansfield, 2009). The QS is usually unaware of those work items when estimating which may

lead to hidden costs during the conservation work. For example, restoration works usually involve works that are not encountered in new-build projects such as de-installation, interim replacement materials, documentation (rubbings & photography), cleaning, disassembly, and matching of materials (Davey, 1992). Also, the cost of obtaining authentic matching materials will drive the materials cost higher than the use of readily available materials in a new work (Davey, 1992). All of these activities add hidden costs beyond those involved in restoration works. With that, the contractor and client may face the budget overrun due to the additional cost needed for a particular building conservation project.

### 1.2 Research problems and question

The conservation of heritage building needs a number of specialists, such as QS, conservation architects, building archaeologist, structural engineers and building contractors in order to conserve the building. Successful heritage conservations are particularly dependent on the quality of the people contracted to do the job (White, 2007). In Malaysia, the involvement of architects and contractors are paramount in most conservation projects. However, it is an additional edge to involve a QS in the early stages of conservation work for better cost control. The lack of understanding in building conservation work often leads to difficulties in estimating an accurate cost.

Furthermore, the absence of important data such as original drawings or specifications requires re-measurement works necessary which leads to more time and works (Mustapa *et.al*, 2005) needed by consultants. Those dealing with new building projects have the benefit of access to drawings and specifications before the

building is actually constructed. However, for conservation projects, the lack of project information such as original drawings, specifications, and costing always lead to difficulties for the QS and contractor to accurately forecast the cost budget to restore them. Hence, many practitioners tend to keep with the familiar and adopt a method of cost estimation which they have used in the past. The QS may prepare a cost budget referring to the cost analysis of past projects and contractors may price the work items based on their past experience on the conservation projects. However, due to the unique nature of conservation works, where each conservation work is different in terms of defective works or remedial works, the work items used for each conservation project are different. As some QS tend to prepare the cost estimation for building conservation works based on their familiarity and experience, in this case, they may miss out some work items if they only refer to the past projects without understanding the conservation work process involved.

The cost of a conservation project cannot be estimated with a high degree of certainty because some cost-setting factors can only be discovered during the process of conservation once the work has begun. What can be determined is the range into which the restoration will fall. The cost of conservation of heritage buildings is relatively higher if work must comply strictly with the guidelines of heritage building (Chai, 2006). This is because there are some additional requirements such as documentation for submission to the local authority and scientific testing required to diagnose the underlying problems. Another major problem in estimating the cost for conservation works is the unknown cost of cost and time in procuring original materials for a particular building and also the cost for skilled labour. All these unknown work items are difficult to be determined by consultants during the

preliminary stage of conservation works as they are different for each project. It is these factors that lead to most hidden costs encountered in conservation projects. The current cost analysis format which is designed only for new-build projects does not allow the surveyors to estimate near to accurate costs for conservation project. Pricing for conservation works is further complicated as no handbooks, manuals or lifecycle data exists in any meaningful sense, as opposed to the new build industry, which has a long tradition of the use of these sorts of publications (Alan and Kayan, 2009). Reports from the industry indicate that the cost overruns is a frequent occurrence in conservation works. By undertaking to understand the causes of this phenomenon, a fundamental research question is raised "What are the unknown work items that are encountered in building conservation works that may lead to hidden costs." This research attempts to identify the hidden costs in building conservation works.

### 1.3 Research aim and objectives

This research aims to identify the reasons for additional costs that are incurred in building conservation works in Malaysia and the following objectives are framed to achieve the said aim:

1. Determine the work items that are frequently missed out in the cost estimating stage for building conservation works. Hence, hidden costs.
2. Determine the factors contributing to these hidden costs in conservation works.

### 1.4 Outline of research methodology

This research adopts the qualitative and quantitative method where a pilot study is carried out before the questionnaire is designed and posted to building practitioners

who have been involved in conservation works. An informal discussion with building practitioners is done in order to obtain the list of potential respondents and also the list of work items that may be missed out during the cost estimation by quantity surveyors. After compiling the name list from different sources such as the Penang Heritage Trust, Jabatan Warisan Negara, and other bodies relating to conservation work, the selected respondents are finalised including building contractors classified under rehabilitation categories in CIDB, quantity surveying consultancy firms, architects, and some other specialists in the building conservation industry. The designed questionnaire includes open and scaled questions and it is comprised of two parts: the first part sought to collect the perception and opinions as well as general information about the cost overruns, while the second part is used to obtain data about the respondents' opinions regarding the cost overruns. The results obtained from the questionnaires are analysed using mean to rank each work item and also the reason for the cost overrun. Descriptive statistics is used in the results analysis where weighted mean is used for ranking and developing metrics for each work item and factor. Results are discussed and special work items used in building conservation projects are identified for future reference.

## 1.5 Implication of findings

Previous research and studies are mainly focused on the architectural side of building conservation works but studies on the cost element of conservation are rare. However, due to unfamiliarity in conservation works, quantity surveyors tend to miss out some special work items that are only encountered in conservation works when estimating the cost. As this may cause cost overruns in conservation projects, this research is aimed indentifying the hidden cost in building conservation works, with the hope that

the findings from this research can be used by building practitioners such as quantity surveyors as a reference when estimating the cost for building conservation projects. Quantity surveyors could be more aware and not missed out these special work items when estimating the budget for building conservation projects. Lastly, it is hoped that from this findings, quantity surveyors could understand more about building conservation works and be more aware of these unforeseen costs when preparing for the cost estimates in future.

## 1.6 Limitation of findings

As like any other research, this research has several limitations such as limitations of complete database. Building conservation work is still considered a new practice in Malaysia where there is no suitable system to record historical buildings in Malaysia (Mustapa *et.al*, 2007). The available data records are mostly kept in a fragmented manner in several historical related government or non-government departments such as The Malaysia Construction Industry Development Board (CIDB), Penang Heritage Trust (PHT), and other departments. The lack of data such as the actual number of conservation works carried out each year or the name list of the building practitioners who are involved in conservation works, puts a limit on the extensiveness of data collected.

In addition, as building conservation work is relatively new in the construction industry in Malaysia, not many examples of conservation works can be drawn from to be used for this research. Thus, it limits the quantity of data that is available for collection. Due to the issue of funding and the area of work being relatively new in Malaysia, not many historical buildings have been conserved compared to that of

other countries. When there is less construction projects, hence the number of building practitioners involved in conservation works are fewer as well. This results in the limitation in this study to involve more respondents for the questionnaires.

## 1.7 Outline of thesis

This thesis is divided into six chapters consisting of three main parts - literature review, research analysis and discussion. Chapter 1 provides readers with a brief introduction on this research. Research background is discussed briefly followed by the research problems and questions. The aim, objectives, implications and limitations of this research are identified. Also, the research methodology and outline of thesis are discussed in this chapter.

Chapter 2 highlights the overview of general building conservation works in Malaysia. An introduction and definition of conservation works are discussed. Principles of conservation work, the guidelines and works method are described in this chapter. Common building defects encountered in heritage buildings in Malaysia are explained and some special work items used in conservation works are discussed. Some other works found in conservation works such as dilapidation survey, scientific testing and laboratory, preliminary items and other related works are also discussed in this chapter.

Chapter 3 focuses on the hidden costs in building conservation works. A brief introduction and definition of hidden cost of conservation works are discussed. Cost estimate methods that are used in conservation works and its problems are discussed. Cost overruns issues are highlighted and relevant issues such as variation orders and

rework in conservation works are elaborated as well as common major work items in conservation works. Factors of rework and factors influencing the hidden costs are also discussed in this chapter.

Chapter 4 shows the research methodology used. A preliminary study is conducted to list out the building practitioners who have been involved in building conservation works. Special work items in conservation works are identified from literature before designing the questionnaire. The completed questionnaire is then distributed to the selected respondents who fit the predetermined criteria for respondents. For the first part of the questionnaire, respondents are asked to rank the frequency of special work items in cost estimate for building conservation works. Further, respondents are asked to give comments on questions such as definition of hidden cost, procurement method used and other factors related to cost overruns in building conservation works. For the second part of the questionnaire, respondents are asked to identify a total of 30 factors that are likely to influence hidden cost in building conservation works. The method of analyses are also highlighted in this chapter.

Chapter 5 analyses the findings from the survey. The results of the data obtained are analysed and discussed in this chapter. The identification, classification and arrangement of the data are tabulated and explained through graphs and text. Chapter 6 outlines the conclusions and the recommendations for future research. Some recommendations are suggested for further research in future. It concludes with a list of specific work items used in building conservation works acquire from this study.

# CHAPTER 2

# BUILDING CONSERVATION WORKS: DEFINITION AND PRACTICES

## 2.1 Introduction

This chapter introduces the fundamentals of building conservation such as the definition of conservation and the principles of conservation. It also provides an overview of conservation practice in Malaysia. Understanding of common building defects in heritage buildings and its conservation repair techniques are important knowledge for Quantity Surveyors (QS) in estimating cost for conservation work. Special work items encountered in building conservation works are highlighted and described in this chapter as well. Features of building conservation such as dilapidation survey, scientific testing and laboratory studies, and other particularly relevant to building conservation works are explained and elaborated in this chapter.

### 2.1.1 Definition of building conservation

In the recent past, conservation professionals have been providing many definitions for conservation. According to Ahmad (1994a), a conservation architect in Malaysia, conservation by definition is guardianship providing for maintenance, preservation or protection of what presently exists, from being destroyed or changed in an appropriate manner. Conservation works are applied on heritage buildings to maintain its originality. It is a conscious process to control and manipulate change to a minimum rate (Australian ICOMOS, 1999; New Zealand ICOMOS, 1992) to ensure the survival of cultural heritage over a long time (Ivanovic, 2009).

In the present day, while different approaches are still predominant in different countries, the preservation of historic buildings is regulated worldwide by the Venice Charter issued in 1964 (D'Ayala and Forsyth, 2007). The Burra Charter (1999) defines that conservation consists of several scopes of works, which could be categorised into several groups. Conservation is defined with a general meaning of preserving and conserving historical buildings, sites, areas or monuments as a national heritage. However, it can be specifically categorised and each category carries a different meaning, outlining and defining the difference on the scope of works that associate with it (Mustapa et al, 2007). The unclear boundaries between the definition of conservation, preservation, restoration, maintenance and refurbishment and others conservation terms are explained in Table 2.1 below, by adopting from the Hoi An protocol (2009) and Burra Charter (1999):

Table 2.1: Conservation work definition

| Clauses | Terminology | Definition |
|---|---|---|
| Hoi An Protocol/ Burra Charter Article 1.4 | Conservation | All the processes of looking after a place so as to retain its cultural significance. Conservation encompasses the activities that are aimed at the safeguarding of a cultural resource so as to retain its historic value and extend its physical life. |
| Hoi An Protocol/ Burra Charter Article 1.6 | Preservation | Maintaining the *fabric* of a *place* in its existing state and retarding deterioration. Preservation encompasses conservation activities that consolidate and maintain the existing form, material and integrity of a resource to retard deterioration. |
| Hoi An Protocol/ Burra Charter Article 1.5 | Repair | It involves restoration or reconstruction and it should be treated accordingly. |
| Hoi An Protocol/ Burra Charter Article 1.5 | Maintenance | The continuous protective care of the fabric and setting of a place, and is to be distinguished from repair. It includes all practical and technical measures that are needed to keep the site in condition at a standard that permits enjoyment of the cultural resource without damage. |
| Hoi An Protocol/ Burra Charter Article 1.7 | Restoration | Returning the existing fabric of a place to a known earlier state by removing accretions or by reassembling existing components without the introduction of new material. |
| Burra Charter Article 1.7 | Rehabilitation | The modification, including adaptive re-use, of resource to meet various functional requirements such as safety, property protection and access while preserving the historic character of the structure. |
| Hoi An Protocol/ Burra Charter Article 1.8 | Reconstruction | Returning a place to a known earlier state and is distinguished from restoration by the introduction of new material into the fabric. |

(Source: Hoi An Protocol 2009, Burra Charter, 1999)

From the Table 2.1, conservation approaches include restoration, adaptive re-use and others. Although there are differing definitions of conservation, basically conservation encompasses the activities that are performed on heritage buildings to retain their originality. Any other activities such as refurbishment work or restoration work that do not re-use the original elements are excluded from the definition of conservation.

### 2.1.2 The principles of conservation

Consultants such as architect, engineer, quantity surveyor and other professionals must be aware of the main conservation principles in order to conserve the building without destroying the origin significance of the existing building. The English Heritage has listed ten main principles of repair, restoration and maintenance of historic buildings (Brereton, 1991), where these main principles has been adopted and used as a basic guide for the conservation of historic buildings and monuments in Malaysia (Ahmad, 1994c). Below are the main principles which are broadly and generally applicable to conservation work in Malaysia.

Table 2.2 Main conservation principles applicable to the built environment

| No | Purpose | Explanation |
|---|---|---|
| A | The purpose of repair | Determining the primary purpose of repair is the most important principle. Its main objective is to prevent the process of decay of building materials and characters while maintaining building structures in good condition. It is also important not to alter any features that give the building its particular historical or architectural significance. |

| No | Purpose | Explanation |
|---|---|---|
| B | The need for repair | The main need for repair is to achieve a sufficiently sound structure, particularly to ensure structural safety and therefore its long-term survival and to meet certain requirements of any appropriate use. Therefore, any intervention during repair must be kept to the minimum in order to stabilize and conserve historic buildings. |
| C | Avoiding unnecessary damage | Any unnecessary replacement of historic fabric should be avoided though the work is carefully carried out. This is to prevent any adverse effect on the appearance effect on the appearance of a building which then significantly reduces its historical or architectural value or seriously diminishes its authenticity. |
| D | Analyzing the causes of defects | Any decayed fabric should be analysed prior to carrying out the work of repair and replacement. This includes an analysis of causes of defects, condition and nature of existing building materials; and a survey of structural defects. The main purpose of carrying out such analyses is to avoid any repetition of building problems or to repeat previous design errors. |
| E | Adopting proven techniques | In order to preserve the appearance and historic integrity of a building and to ensure that repairs have an appropriate life, all repair work should match existing materials and methods of construction. Therefore, any new methods and techniques of repair should only be carried out when they have proved themselves over a long period and also where traditional alternatives cannot be found. However, the degree of damage caused to the buildings' appearance, historic integrity and fabric should be considered when deciding to adopt new methods and techniques. |
| F | Truth to materials | In carrying out repairs for building materials, it is important to execute the work honestly. There should be sincerity to the materials and also the whole building as well. However, repairs should be dated discreetly where appropriate. |
| G | Removal of damaging previous alterations | In some cases, additions or alterations are of importance for the part they play in the cumulative history of a building. In fact, there will often be a strong presumption in favour of their retention. |

| No | Purpose | Explanation |
|---|---|---|
| H | Restoration of lost features | Some elements of an historic building, for example balustrades, pinnacles, cornices, festoons or window tracery, may have been broken or lost in the past. If they are of structural significance, then they should be restored or replaced in the course of repair. However, to avoid inaccurate and unnecessary replacement, sufficient evidence should be provided to support both the existence and form of the lost features. |
| I | Safeguarding the future | Like other historical objects, buildings of architectural and historical significance should be regularly monitored and maintained. Reviews should include public safety and access, protection of historic buildings from traffic, fire and security; and preventive maintenance. |

(Source: Ahmad, 1994c)

The reason quantity surveyors need to understand the principles of conservation work is so that they are clear with the work process of conservation work, the techniques and methods to be employed in conservation work, and the special work items found only in conservation work. This information is important as quantity surveyors would refer to these principles to know what work item is to be included in their cost estimate for conservation projects. For example, one of the principles listed in Table 2.2 is analysing the causes of defects. If quantity surveyors understand the building defects that are commonly encountered on historical buildings, they are more aware and know what type of common scientific testing and laboratory testing should be included in cost estimates in conservation projects. Similarly with restoration of lost features, if quantity surveyors understand the meaning of this conservation principle, they would know to include the cost for repairing or replacing broken and old elements which are commonly found in heritage buildings such as balustrades, cornices and festoons. If quantity surveyors are not familiar with

conservation principles, they may miss out the major cost items during their estimation and such oversight may create the hidden cost problems.

## 2.2 Overview of conservation practice in Malaysia

Malaysia is one of the fortunate countries that have many historic buildings which have immense architectural and historical values (Ahmad, 1998). Presently, there are more than twenty thousand historical buildings and two listed heritage cities by UNESCO – GeorgeTown and Malacca. In Malaysia, the practice of building conservation is considered new in the local construction industry. According to Laurence Loh, a conservation architect in Penang, conservation is still a marginal activity that is not seen as central to Malaysia's core values (Hsu, 2007). In the past few years, many historic buildings have been preserved and conserved while others have been converted to become premises for a bank, restaurant, information centre or a printing office (Ahmad, 1994a). Yet, many historic buildings in Malaysia are still under threat.

This can be proved by the latest statistics provided by The Penang Heritage Trust (PHT) in the year 2008, where there are about 4,655 shop houses in the inner city of Georgetown of which 500 are dilapidated and abandoned. According to data provided by The George Town World Office in year 2010, to date, there are a total of 118 dilapidated shophouses in the heritage zone which are in dire need of conservation (Chin, 2010). These heritage buildings are abandoned because of difficulty in finding viable new uses for vacant or underused buildings. Some of the house owners of heritage buildings are reluctant to spend money conserving the buildings which are usually rented to tenants (Ooi, 2008).

Although conservation projects are difficult to manage, it had grown rapidly in Malaysia for some years (Ali et al, 2008). This is proved by the statistics (CIDB, 2007) reported that conservation works constituted 16 percent of the total Malaysian construction output in the year 2006. It is anticipated that the conservation industry is likely to become one of the important sectors in the construction industry. This is mainly due to several reasons such as the increasing number of ageing buildings, limited vacant land for new development and technological change, especially the use of information communication technology (Rahmat et al, 2003; Ali et al, 2008). When heritage buildings reach certain years of age, they need to be inspected regularly and conserved to maintain its originality. The limited vacant land may cause people to conserve the existing old buildings and thus more conservation activities would be performed in next few years. All this indicates the growing importance of the conservation sector and calls for a greater understanding and knowledge in managing these buildings (Ali et al, 2008).

Historic buildings in Malaysia can be classified into several categories such as traditional architecture like the timber Malay houses, shop houses of unique architectural styles such as the Straits Eclectic Style or the Art Deco, colonial influence (railway stations, old government buildings, mansions and courthouses); and religious buildings (traditional and Moorish-influence mosques, churches and temples) (Ahmad, 1998). Until today, some of these buildings still remain intact and maintain their original characters whilst others have been repainted for several times or have new additions to the buildings. There are also a few that have been left abandoned or demolished to give way to modern development (Ahmad, 1998).

Presently, conservation practice in Malaysia is guided by the principles of the Australian ICOMOS Burra Charter which is widely accepted in Malaysia and internationally (Ahmad, 2005). In Malaysia, under The Antiquities Act 1976, a historic building or monument aged at least 100 years old can be gazetted by the government through the National Museum to provide protection and encouragement for preservation and conservation (Ahmad, 1994a). The National Museum is given legislative powers by the government to gazette such buildings. However, from year 2005 onwards, this act was repealed and replaced with National Heritage Act 2005, where the legislative power is with the Department of National Heritage and no longer with the Department of National Museum. An inventory study undertaken in 1992 and 1993 by the Heritage Trust of Malaysia revealed that there are about 39,000 historic buildings built between 1800 and 1948 throughout the country which are worthy for preservation and conservation (Idid, 1995).

This inventory study also classified the buildings built within the 1800 to 1948 period as 'pre-war buildings' (Idid, 1995). Listed in Table 2.3 is the number of 'pre-war buildings' located in 247 cities and towns in Malaysia. This study shows that Penang has the highest number of historical buildings in Malaysia. From the information collected from different reliable sources such as The Penang Municipal Council, Penang Heritage Trust, Jabatan Warisan Negara and other organisations relating to building conservation, it is found that the majority of building conservation practitioners are in Penang, due to more conservation projects undertaken in Penang compared to that of other states.

Table 2.3: Number of pre-war buildings in 14 states in Malaysia

| No | States | Number of Historical Buildings | Percentage of Historical Buildings (%) |
|---|---|---|---|
| 1 | Penang | 5,057 | 24.33% |
| 2 | Perak | 3,351 | 16.12% |
| 3 | Johore | 2,323 | 11.18% |
| 4 | Malacca | 2,177 | 10.47% |
| 5 | Kuala Lumpur | 1,763 | 8.48% |
| 6 | Kedah | 1,282 | 6.17% |
| 7 | Selangor | 1,166 | 5.61% |
| 8 | Sarawak | 1,010 | 4.86% |
| 9 | Negeri Sembilan | 999 | 4.81% |
| 10 | Pahang | 831 | 4.00% |
| 11 | Terengganu | 420 | 2.02% |
| 12 | Kelantan | 373 | 1.80% |
| 13 | Perlis | 25 | 0.12% |
| 14 | Sabah | 10 | 0.05% |
| | Total | 20787 | |

(Source: Idid, 1995)

Further, the following shows the guidelines for heritage buildings by the Municipal Council of Penang Island (MPPP), which is applicable for reference of other heritage buildings in Malaysia.

a) The existing external appearance of the building shall be preserved and no alteration to any part of the facade shall be permitted, other than works necessary for restoring it to, and maintaining it in, a proper state of repair.
b) Partial site redevelopment may be permitted depending on the situation.
c) Any addition or extension to the existing building shall only be permitted depending on the merit of the proposal.
d) Interior alterations shall be permitted subject to approval by the Council.
e) Adaptive re-use of the building shall be permitted so long as the appearance of the building is not impaired.
f) Any reroofing shall be of the original material or material close to the original.
g) No mechanical ventilation or part therefore shall be visible from the street.

However, for government buildings like the City Hall or the Town Hall, there is a strict requirement set by the local council whereby there should be no demolition, alteration or extension of the building other than development or works necessary for restoring it to, and maintaining it in, a proper state of repair.

### 2.3 Understanding common building defects in heritage buildings

In old buildings, building elements such as the roof, exterior walls, floor structures and others work items are likely to become dilapidated due to weathering or ageing. According to conservation architect Ooi Bok Kim (2008), there are three main areas of concern when it comes to restoring heritage buildings in Malaysia, which are the roof, facade and five-footway where the five-footway is only applied to shop houses. The deterioration process normally affects the exterior facade of building first, followed by the interior (Hollis and Gibson, 2004). The roof structure of heritage buildings tends to be damaged due to the longer period of weather exposure. The strength of brickwall is slowly deteriorated as the buildings become old. In addition, the vegetation growth causes cracks in walls. Cracks in walls could lead to the occurrence of dampness inside the building (Hollis and Gibson, 2004).

Broadly, the problems faced in conserving buildings are derived from the heritage building style, the materials used, the quality of the original design and execution, or the exposure of the structure to weather and the standard of upkeep (Butler, 1980). Unlike modern or newly constructed buildings, heritage buildings are more prone to building decays or defects such as termite attacks, dampness, roof leakage, poor rainwater goods, harmful growth and peeling paint (Ahmad, 1998). Such building defects may destroy the buildings if they are not repaired and maintained regularly.

As shown in Table 2.4, studies by Ahmad (1998) highlighted several building defects that are commonly found in heritage buildings in Malaysia:

Table 2.4 Top threats of Malaysia's historical buildings

| No | Building Defects | Explanation |
|---|---|---|
| 1 | Fungus stain and harmful growth | Fungus stain occurs when there is moisture content in the wall. Harmful growth includes creeping and ivy plants that can grow either on walls, roofs and gutters. It usually happens when dirt penetrate small openings in the walls and mortar joints, creating suitable ground for seeds to grow. Roots can go deep into the existing holes causing further cracks and water penetration. |
| 2 | Erosion of mortar joints | Causes include salt crystallization, scouring action of winds, the disintegrating effects of wall-growing plant, and water penetration resulting in dampness. |
| 3 | Peeling paint | Usually occurs on building facades, mainly on plastered walls, columns and other areas that are exposed to excessive rain and dampness. In many heritage buildings, several layers of paints have been applied onto the plastered walls over the decades. |
| 4 | Defective plastered renderings | Occurs mostly on the external walls, columns and ceiling. Defective renderings are caused either by biological attacks, harmful growth, shrinkage or movement in the substrate. |
| 5 | Cracking of walls and leaning walls | Vertical or diagonal cracks in the wall are common symptoms of structural instability. Common causes of leaning walls include a spreading roof. |
| 6 | Defective rainwater goods | Problems include sagging or missing eaves, gutters, corroded or broken downpipes, and leaking rainwater heads. |
| 7 | Decayed floorboards | Widely used in many heritage buildings including church, schools, residences and railway stations. Main causes are pest attacks, careless lifting of weakened boards, lack of natural preservatives and corroded nails. |
| 8 | Insect or termite attacks | Insect or termite attacks pose a threat to damp timber found in wall plates, the feet of rafters, bearing ends of beams and trusses. Affected timber can be treated by pressure-spraying with insecticide or fumigant insecticidal processes. |
| 9 | Roof defects | In Malaysia, clay roof tiles have been widely used in the heritage buildings. Common defects of roof tiles include corrosion of nails, the decay of battens, and cracking of tiles caused by harmful growth. |

| No | Building Defects | Explanation |
|---|---|---|
| 10 | Dampness penetration through walls | Water penetration occurs commonly though walls exposed to prevailing wet wind or rain. Dampness also occurs in walls due to leaking gutters or downpipes, defective drains, burst plumbing and condensation due to inadequate ventilation. |
| 11 | Unstable foundations | It may occur due to shrinking clay soil, penetration of dampness and water that may decay walls and foundations, deteriorating building materials and increased loads. |
| 12 | Poor installation of air-conditioning units | Subject to building structures of heritage buildings, the cooler drier air may cause shrinkage of building materials. |

(Source: Ahmad, 1998)

For any building conservation works, it is important to examine a building in detail prior to any conservation works as it can yield much information about present the condition of a building. There are different causes to building defects which vary according to building locations, poor maintenance, climate conditions, structural failures and inappropriate uses of new buildings (Ahmad, 1998). Hence, the more information on defective building structures, the better a decision is made for further remedial works. This is also to ensure that conservation work is carried out properly and is in accord not only with the building requirements but is within the scope of contemporary knowledge of the subject (Ahmad, 1994a).

### 2.4 Conservation work process

In the words of Sir Bernard Feilden, an architect and distinguished expert of heritage conservation, the conservation of buildings is a complex series of actions taken coordinately by several professionals in order to prevent the decay of a building while preserving and enhancing the cultural values embedded in it (Feilden, 2003). The professionals involved include conservation architects, archaeologists, specialised engineers, building contractors, and quantity surveyors. Sometimes, they

may be supported by other skilled workers such as craftsmen, biologists, chemists and geologists (Ahmad, 1998).

Building conservation works in Malaysia are generally carried out based on the requirements set out by the Jabatan Warisan Negara which this department is established in year 2006. According to Ahmad (2004), a building conservationist in Malaysia, generally there are three main requirements in conservation based on the basic principles of minimum intervention on building structures and fabric which are as follows:

i. Historical Architectural Building Survey (HABS) to record the building conditions before, during and after the conservation works.
ii. Scientific testing and laboratory studies of building conditions and materials.
iii. Proven conservation methods and techniques to deal with building problems or defects.

Conservation should be carried out without destroying historical evidence of the building. Hence, when conserving heritage buildings, to ensure the originality of existing building structures are retained, the conservation process should follow closely the work preparation of the HABS survey and scientific studies to the conservation methods and techniques.

It can be said that technically all conservation work is always difficult and complicated (Low and Wong, 1997). This is due to the methods and sequence of conservation works as opposed to new construction works. For new building works,

the work commences from foundation to the roof. Whilst in building conservation, the work commences from the roof down to the foundation of buildings.

In order to decide on the remedial works undertaken, the history of the building should be firstly studied. The building's physical conditions such as its level of deterioration or its defective works should be identified prior to the commencement of remedial works. Low and Wong (1997) has also discussed the general work sequence of building conservation works by taking an example of a conservation project at Chinatown in Singapore

**2.5 Special work items in conservation works**

In building conservation works, there are special work items that occur in building conservation works such as dilapidation survey, scientific testing and laboratory studies, temporary roofing and others. These work items are not usually aware by quantity surveyors who are not familiar with building conservation works. The problem may arise if inexperienced quantity surveyors miss out to include these special work items in the cost estimate and cause cost overruns in the conservation project. The contractors will need to incur additional costs to carry out the remedial works if those work items that are not stated clearly during the tendering stage. The client may need to bear the loss if quantity surveyor makes this mistake by missing out those work items. Therefore, if a quantity surveyor is familiar with the conservation work process, he would know what work items to be included in cost estimation for conservation projects. Ultimately, this would reduce the chance of overlooking any special work items that are usually unknown to quantity surveyors, especially to those who are unfamiliar with building conservation works.

In general, there four main phases in identifying problems associated with heritage buildings before commencing the conservation work on site, namely the reconnaissance survey, dilapidation survey, scientific testing and laboratory studies (Ahmad and Rahman, 2005). Reconnaissance survey and dilapidation survey are parts considered under research and documentation works prior to commencement of conservation works on site. These main work items which are only used in building conservation works are essential as it may lead to cost overruns in projects if quantity surveyors miss out to include these items in their cost estimate. In other words, it is essential for quantity surveyors to understand these special work items in detail, in order to know the cost implication for building conservation works.

### 2.5.1 Reconnaissance survey

Reconnaissance survey is an initial step for the survey of heritage building, where it involves a general investigation of the building's interior and exterior to gauge the nature and extent of the building's problems (Ahmad, 2005). The benefits of conducting reconnaissance survey is it would save much time and field work by studying significant historical resources, extant building plans and photographs as part of a reconnaissance survey (Lee and Lim, 2010). In order to ease the work on site and for documentation purpose, the building plan is usually categorised into grid zones (Ahmad, 2005). This survey provides the building conservationist an opportunity to check the actual conditions on the ground and note if there is any discrepancies in the drawings.