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ORIGINAL LITERARY WORK DECLARATION

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STANDARD GUIDELINES FOR BILL OF QUANTITIES CUSTOMISED FOR BUILDING CONSERVATION WORKS: THE MALAYSIAN CONTEXT

Field of Study : **Procurement & Contract Administration**

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ABSTRACT

The aim of this research is to formulate a guideline for preparing Bill of Quantities (BQ) for building conservation works. The justifications for this research are derived from both the practical and the academic angle. Anecdotal feedback from the conservation industry claims that the variance between tender prices of conservation projects is very high and this issue poses difficulty in the awarding of contracts. In any tender pricing, BQ is the most important part of the tendering process. Thus, the issue of tender pricing requires research on the BQ document itself. While the subject pertaining to BQs has been researched since the 1960s covering various areas such as type, use, format, pricing, reliability and relevance of the BQs; all these studies focused on new building works and not conservation works. Thus the reason for the high variance in conservation tenders is still unknown yet the rising interest in conservation works in this country has created the need to improve the area of tender pricing for the conservation industry. Qualitative research approach is used in this study and the reason is due to the situation and character of the conservation industry where data are still scarce and there are still many unknowns pertaining to tender pricing for conservation works. In order to uncover and probe deeper into the issues faced by these tenderers, semi-structured interviews are conducted with conservation contractors. Data from the interviews are analysed using the thematic analysis method. The findings revealed that hidden works, inexperience in the conservation industry, various issues with the BQ preparation, as well as labour and material costs are the major reasons for the variance in tenders for conservation projects. The interviews also revealed the inadequacies of the current tender documents which were then categorised into three categories namely BQ, Specification and Documents other than BQ. The data also identified items that had no effect on pricing. Suggestions from the interviews formed the basis for the

proposed guidelines which were then validated under four sections namely Guidelines for Preliminaries Bill, Measured Work Bill, P.C. & Provisional Sum Bill and Documents other than BQ. Considering the impossibility of testing the guidelines in the industry during the research period yet the proposed guidelines needed validation, this study used the 2-round Delphi survey method to obtain feedback from industry experts on the feasibility and viability of the guidelines. Feedback from the 2-round Delphi survey are then used to revise and improve the proposed guidelines to derive to its final version proposed in this research. It is hoped that the proposed guidelines will be used by quantity surveyors as reference in the preparation of tender documents for building conservation projects in the immediate future.

ABSTRAK

Tujuan kajian ini adalah untuk merangka garis panduan untuk menyediakan jadual harga (BQ) untuk kerja-kerja pemuliharaan bangunan. Justifikasi untuk kajian ini diperolehi daripada kedua-dua sudut praktikal dan sudut akademik. Maklum balas anekdot daripada industri pemuliharaan menyatakan bahawa perbezaan harga tender antara penender untuk projek pemuliharaan adalah sangat tinggi dan isu ini menimbulkan kesukaran dalam penganugerahan kontrak. Dalam mana-mana harga tender, BQ adalah bahagian yang paling penting dalam tender. Oleh itu, untuk menangani isu mengenai harga tender maka kajian perlu dijalankan ke atas dokumen BQ. Walaupun subjek yang berkaitan dengan BQ telah dikaji sejak tahun 1960-an dan merangkumi pelbagai bidang seperti jenis, penggunaan, format, harga, kebolehpercayaan dan kesesuaian BQ, semua kajian ini memberi tumpuan kepada kerja-kerja bangunan baru dan bukan kepada kerja-kerja pemuliharaan. Justru itu, faktor yang menyebabkan varians yang tinggi dalam tender pemuliharaan masih tidak diketahui. Memandangkan minat dalam kerja-kerja pemuliharaan yang semakin meningkat di negara ini, maka timbul keperluan untuk menambah pengetahuan dan mempertingkatkan lagi kemahiran penentuan harga tender bagi industri pemuliharaan. Pendekatan penyelidikan kualitatif digunakan dalam kajian ini kerana kebolehdapatan data masih terhad dalam industri pemuliharaan dan juga masih banyak aspek yang belum diketahui berkaitan dengan harga tender bagi kerja-kerja pemuliharaan. Dalam usaha untuk mendedahkan dan menyiasat dengan lebih mendalam isu-isu yang dihadapi oleh penender, temu bual separa struktur dijalankan dengan kontraktor pemuliharaan. Data daripada temu bual dianalisis menggunakan kaedah analisis tematik. Dapatan kajian menunjukkan bahawa kerja-kerja yang tersembunyi, kurang pengalaman, bil

kuantiti serta kos buruh dan bahan adalah sebab-sebab utama yang menyebabkan varians dalam tender untuk projek-projek pemuliharaan. Temu bual juga mendedahkan kekurangan dokumen tender semasa dan kekurangan ini dikategorikan kepada tiga kategori iaitu BQ, Spesifikasi dan Dokumen selain daripada BQ. Data juga mengenal pasti perkara-perkara yang tidak mempunyai kesan ke atas harga. Cadangan-cadangan daripada temubual membentuk asas bagi garis panduan yang dicadangkan dan cadangan ini dibahagikan kepada empat bahagian iaitu garispanduan untuk jadual kerja Kerja Pendahuluan, jadual kerja Kerja Bangunan, jadual kerja Wang Kos Prima & Wang Peruntukan Sementara dan Dokumen selain daripada BQ. Memandangkan adalah mustahil untuk menguji kegunaan garis panduan yang dicadangkan di industri dalam tempoh kajian ini, maka kaedah pengesahan alternatif diperlukan. Oleh itu kajian ini telah menggunakan kaedah Delphi 2-pusingan untuk mendapatkan maklum balas daripada pakar-pakar industri mengenai kebolehkerjaan dan daya maju garis panduan yang dicadangkan ini. Maklum balas daripada kaedah Delphi 2-pusingan digunakan untuk menyemak semula dan menambahbaik garis panduan yang dicadangkan kepada versi terakhir dalam kajian ini. Adalah diharapkan garis panduan yang dicadangkan ini boleh digunapakai oleh juruukur bahan sebagai rujukan semasa menyediakan dokumen tender untuk projek pemuliharaan bangunan warisan di masa yang terdekat.

ACKNOWLEDGEMENT

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AAQS SMM	:	Standard Method of Measuring Building Works for Africa 2015 First Edition
BQ	:	Bills of Quantities
CRP	:	Conservation Related Preliminaries
CV	:	Coefficient of Variation
HABS	:	Historical and Architectural Building Survey
NRM2	:	RICS new rules of measurement: Detailed measurement for building Works
P.C.	:	Prime Cost
POMI	:	Principles of Measurement (International) for Works of Construction 1979
RICS	:	Royal Institution of Chartered Surveyors
RISM	:	Royal Institution of Surveyors Malaysia
SMM2	:	Standard Method of Measurement for Building Works Second Edition
SSMM2	:	Singapore Standard Method of Measurement for Building Works Second Edition
UK	:	United Kingdom

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CHAPTER 1: INTRODUCTION

1.1 Background

Conservation works in this study is defined as work on historic or heritage buildings that comprises preservation, refurbishment, rehabilitation, maintenance, restoration, reconstruction, repair and adaptive reuse (Bullen, 2007; Dann & Wood, 2004). Although conservation works are considered as part of the construction sector, there are differences between new build works and conservation works due to the different methods and processes involved during conservation and restoration. However, between conservation works and refurbishment, there exists similarity where both types of work tend to have small labour intensive operations scattered throughout existing buildings (Quah, 1992).

Works on old buildings, be it rehabilitation, preservation or adaptive reuse are usually categorised as building conservation works. Such works are considered as a sub-sector in the construction industry due to the different methods and processes involved during conservation and restoration as compared to new building works. Increased conservation activities not only benefitted the preservation of culture and history of the cities but also promoted the growth in the conservation sub-sector of the construction industry. However, as the increase in conservation activities in this country is fairly recent, the industry experiences a gap in the knowledge and established procedures in the management of conservation construction activities. The issues span a wide spectrum, from technical knowledge in conservation methods and materials to budgeting and cost management. While conservation processes are widely researched, the same cannot be said for the cost management aspect, namely cost estimating, cost budgeting and cost control. Although this area may not be seen as conservation per se,

cost management is an important part of any project. Good cost management will enable the tender figure to be closer to the estimate, having good value achieved for the project, reducing project risk, and with budget opportunities and threats fully identified and assessed (Kirkham, 2007). In any building conservation project, one of the main concerns is the cost of restoration. Owners perceive that conserving a building would cost higher than building a new one. Their concerns may not be far off as the capital cost of restoration could be higher due to the types of construction method as well as the costs of labour and materials (Brandon, 1982). In addition, Dann and Wood (2004) found that conservation of historic buildings requires additional layers of bureaucratic approval and perceived costs that constitute burdens on the clients and building contractors.

There are constraints that are found in conservation works which may add to the cost. Commonly known is the special requirement in restoration works that needs to be complied with in order to protect the authenticity of the building architecture. In addition to that, conservation works are also executed within a confined space in an existing building. As such, it is usually believed that repair and maintenance work to old buildings are generally more costly than that of modern buildings, due mainly to the types of construction encountered, labour and material costs (Brandon, 1982). Although a quantity surveyor is able to estimate the cost of a new building within a reasonable range, estimating the costs for building conservation works is not as easy. Conservation works estimate needs a more careful analysis of the scope of works and a different approach from that of conventional estimating (Ahuja & Campbell, 1988).

However, the conservation industry in this country is experiencing difficulty in estimating the cost for conservation works because feedback from the industry indicates

that there is high variance among conservation works tenders. This problem causes difficulty in the assessment of tenders and selection of successful bid. There will be doubt on the reasonableness and competitiveness of the price when there is high variability among the tenders amount. Akintoye (2000) in his study has commented that the impact of inaccurate cost estimating on contracting business is significant. Overestimated costs may lead to the tender being unacceptable to the client while an underestimated cost may lead to losses to the contractor (Akintoye & Skitmore, 1991).

Although tender variability also happens all the time for new build project, it is usually within a consistently small range. Skitmore (1981) in his study explains that there are two major variables that may cause variability in the tender amount, one is the cost estimate and the other is the mark-up by the contractor. Usually the cost estimate that is produced before the commencement of work is obtained from the tendering submission where the pricing for the works is based on information contained in the tender document.

In the traditional procurement route for tenders with quantities, the tender document is divided into different sections such as Instruction to Tenderers, Form of Tender, Conditions of Tendering, Standard Specification, Preambles, Bills of Quantities (BQ), Final Summary and Appendices. In all of the above sections, the BQ is the most critical section used in estimating the cost of the project. It also provides a common basis for the pricing and comparison of bids (Kodikara, Thorpe & McCaffer, 1993) so that the client could obtain the most competitive tender. However, if there is high variability in the tenders, this must mean that the cost estimate produced by the tenderers could be flawed but thus far, this issue has only been identified from anecdotal evidence gathered from the industry. While there is no specific study on the high variability of

conservation works tenders, Lee (2009) studying the current tender preparation processes, key issues and variables that are crucial to building conservation work found that BQ are incomplete and descriptions are not clear. Format for BQ is also found to be not standardised throughout the industry. Lee (2009) also suggests that tender preparation for works specific to building conservation should be specially prepared with conservation requirement taken into consideration. A study by Quah (1992) on variability of tender bids for refurbishment works also found that poor document format, poor and incomplete description and insufficient information are problems encountered with the tender documents in refurbishment works. These problems are identified as reasons that contributed to the high variability in refurbishment work tenders. Although not all refurbishment works are meant to conserve heritage buildings, the similarities between refurbishment and conservation works may mean that some of the factors identified by Quah (1992) may be applicable to conservation works.

As such, it can be seen both studies found that variability in document format, poor and incomplete description and insufficient information are problems encountered with the tender documents that pertains to refurbishment and conservation works. Considering that conservation works is on the rise in our twin heritage cities, it is now timely to find a solution to the issues discussed above for the betterment of the conservation industry.

1.2 Problem Statement

The issues discussed above indicate that BQ seems to be central to issues concerning tenders. A scrutiny of researches on BQ reveals that research on BQ goes as far back as the 1960s where the main area of research on BQ centres on introducing and promoting

the operational bill and to a lesser extent the activity bill (Mohd Hisham & Azman, 2008). This particular area of study has seem to fizzled out with hardly any study done since then until 2008 where Mohd Hisham and Azman (2008) tries to bring back the operational bills. However, until now the operational bill format has not caught on and is not used by the construction industry.

The areas of research from the 1970s until 1980s focused on the use and format of BQ. Research during this period is also interested in studying the pricing of the BQ and its reliability for estimating. However, the study of the use of BQ continues to fascinate researchers as this area of research continues to crop up in the 1990s and 2000s. However, the latter researches probed a wider use of BQ where it is not only confined to tendering but also on how the information in a BQ can benefit contractors during the construction period. During the late 2000s, the research areas centre on the relevance and effectiveness of BQ. Although the various studies on BQ ranges from the use of BQ (Davis & Baccarini, 2004), on the accuracy and reliability of bill of quantities for estimating (Morrison, 1984; Odeyinka & Perera, 2009) to the relevance of the bills of quantities in today construction industry (Pasquire & Tyler, 1987; Rashid, Mustapa, & Wahid, 2006), these studies are based on the construction of new building and not on conservation of heritage building.

Davis, Love, and Baccarini (2009) looked into the type of bill of quantities that is relevant to the current construction needs but his study is also based on construction of new buildings and not conservation works. Even with the use of modern search engines and databases, the literature on bill of quantities in general and conservation works specifically is lacking. Nevertheless, there are various researches that are not on BQ per se but are related to the bill of quantities. Such research focus on areas such as causes

of claims, delays and cost overruns (Semple, Hartman, & Jergeas, 1994) and cost estimating (Stevens, 1983). There are also studies on the use of BQ in various type of projects such as civil, institutional, high-rise apartment building, and petrochemical projects (Semple et al., 1994) as well as in civil engineering works (Banjoko, 1985; Hoare & Broome, 2001; Wallace, 1974) but none was found for building conservation works. Even for new build, Davis and Baccarini (2004) found that there is little empirical research into the use of BQs. They explained that much of the literature that they found is based on unsubstantiated opinion.

However, due to the time lapse between previous studies on BQ and this research, it is pertinent to ascertain if the bill of quantities is still a relevant document now and would justify further study on it. Kodikara, Thorpe, and McCaffer (1993) suggest that the information stored in the BQ should be arranged in a directly useable way and information need to be presented in a more meaningful format. Odeyinka and Perera (2009) concluded that BQ is less reliable in guaranteeing cost certainty for project that is more complex in nature.

On the other hand, Davis and Baccarini (2004) conducted their study to find out issues related to the use of BQs in construction projects and found that two criteria calls for the production of BQ in construction project. The criteria identified are project complexity and monetary value. Therefore, BQs are produced as a means to facilitate quality assurance and greater understanding in complex and/or large projects. Rashid et al. (2006) found that the usefulness or relevance of BQ as project and cost information depends on the type, nature and magnitude of the information that is needed for cost reporting, and monitoring and controlling of project cost. It also depends on the types and emphasis of the project, the requirements of the owners and the construction

business environment. Where cost is the emphasis of the project and fund is limited, it is appropriate to use BQ because it contains very detail project cost that can be used for detail project accounting and summarised financial reporting.

This indicates that BQ still has its usefulness and relevance depending on the criteria of the project and requirement of the client. The above studies also indicates that a clear BQ would provide a better understanding of the works as well as providing detail cost information for cost management in the project. Considering the nature of conservation works consists of small complex works and currently without sufficient database for reference, therefore basing on Davis and Baccarini (2004) criteria, BQ is relevant to conservation works. Producing a complete BQ would enable a clearer understanding of the works needed and thus enable pricing to include for all the required works.

However, the usual practice in preparing bill of quantities in building conservation works is by using the conventional format of bill of quantities for new works. This approach does not work well as can be seen from the findings in the thesis by Lee (2009). Currently, bills of quantities prepared for conservation works do not follow any standard template or guidelines specifically cater for conservation works. Each consultant prepares the document according to the firm own house style. As such there exist in the industry various styles of bill of quantities which confuses the contractors as well as the consultant team. This is because some BQ are prepared in detail, some in lump-sum while some uses provisional sum liberally. Tender documents for building conservation work should contain, in addition to the standard requisites for construction work, information such as the conditions of buildings, reports of site investigations and specific documents such as reports from the dilapidation survey and other scientific and technical surveys (Ahmad & Rahman, 2005; Hamid, 2008). All these information are

specially obtained for preparing project briefs, building specifications and Bill of Quantities for building conservation projects.

Considering the paucity of information on tendering for building conservation work, data on refurbishment works are also studied as there are similarities in both type of works namely, it consists of small labour intensive operations where the works are scattered throughout the existing building. There is also a lack of as-built drawings to guide designer and builder. In addition to that, sometimes the extent of work is not discovered until demounting work has commenced. All these characteristics create difficulty in the planning and estimating works due to the unknowns and uncertainty (Egbu, 1995) in the extent of repair works needed. While the Construction Industry Development Board of Malaysia and the Public Works Department published statistical data on construction, tendering data on refurbishment works is not included in their publication. The difficulty in obtaining information on refurbishment work does not only occur in this research but other researchers also faced the same problem. Azlan, Syahrul and Hafez (2009) states that there is no comprehensive and accurate data on the value of refurbishment works in Malaysia and most local authorities do not have complete database on refurbishment works. McKim, Hegazy and Attalla (2000) lament that very little usable information was found in the literature regarding reconstruction works which they defined as works covering simple interior renovation to major phased replacement of occupied facilities.

Conservation of heritage building in Malaysia has picked up only after the inscription of George Town and Melaka as World Heritage Cities in 2008. As conservation works is a sub-set of construction works, there is no difference in the tendering system of conservation projects. The procedure and methods currently used

in the industry are the same as new build works. Based on the existing projects, it can be seen that major conservation works are tendered out based on bill of quantities while some minor works are tendered out based on design and build method. However, the criticism of the design and build method centres on the brevity of tender documents which makes it difficult for assessment of the costing during tender evaluation and construction stage (Wee, 2011). While bills of quantities is time consuming to produce, it provides a more comprehensive costing information and details such as rates and prices, general risks liabilities and express and/or implied contractual obligations (Rashid et. al., 2006; Kodikara et. al.,1993).

In view of the above issue, the establishment of standard tender document, especially the bill of quantities that is specifically catered to building conservation projects is very much needed to enhance the cost management of building conservation contracts. Past study has noted that more research is needed in this area to identify ways to enhance the administration of conservation projects (Lee & Lim, 2009). Wee and Lim (2010) has also found that cost information and document for conservation is still insufficient despite the increase in building conservation projects. This could be due to the reason that cost estimating for building conservation works is complex and difficult (Smith, 2005) and considering that the works in building conservation are different from new build, the same format cannot be used in preparing cost estimate for conservation works (Wee & Lim, 2010). The scarcity of information on cost management for building conservation is now more distinct as the number of works in this area increases.

Lee and Lim (2009) explained that non-standardization of preliminaries bills and BQ will cause considerable confusion during contract administration. As such, they suggested that standardizing such documents will ensure a higher degree of

compatibility, interoperability, safety and quality. It will also reduce confusion by making it easier for the different construction team members to understand the contents of the document.

The rationale for establishing a guideline for bill of quantities in conservation work has been discussed under three areas. Firstly the lack of research on bill of quantities in general and an even lesser research on the format of bill of quantities for conservation work. Secondly, the relevance of bill of quantities in construction project and thirdly, the current format of bill of quantities for use in conservation works are found to be weak in terms of completeness and standardisation. Based on these reasons, this research is conducted to fill in the gaps discussed above.

1.3 Research Aim and Objectives

Following from the research question, the aim of this study is to formulate a guideline for preparing bill of quantities which would embody the needs and works that are particular to building conservation. This research attempts to define the bill of quantities that reflects the nature of conservation works which would enable accurate tender pricing.

The objectives below are formulated to achieve this aim.

1. To ascertain the extent of pricing differences between tenders in building conservation works.
2. To identify the adequacy of tender documents currently used in building conservation tendering in terms of format and sufficiency of information to enable accurate cost estimating.
3. To establish a guideline for the preparation of bills of quantities in building conservation works.

Endeavouring to achieve the above objectives, the following research questions are asked. The research questions form the foundation for the direction of this research.

1. What is the variance of tender amount in conservation works?
2. What are the reasons for the variance?
3. How does conservation process affect the pricing level?
4. Is the current BQ format suitable for pricing conservation works?
5. What is the format and content for bill of quantities that will enable contractors to price in a uniform and competitive manner for building conservation works tender?

Research question 1 is to seek answers to achieve Objective 1. Identifying the variance of tender amount would provide information on the pricing differences between tenders. Upon identifying the variance level, the next logical question would be "what are the reasons for the variance". Determining the reasons would give an indication of the problems faced by tenderers in pricing the tenders of conservation projects. This helps the research in understanding the problems. Question 3 and 4 are formulated to seek answers to achieve Objective 2 which is to find out if the current format of tender documents is suitable for tender pricing. Having an understanding of how the conservation process affect pricing and the suitability of the current tender documents would enable the research to formulate the next step of the process which is to develop a template for a bill of quantities. This is the answer seek by question 5 to achieve the research Objective 3.

1.4 Research Structure and Methodology

Following from the above, the entire research structure adopted is shown in Table 1.1 below for ease of reference. This table present the methods and instruments that are used in this research as well as the analysis techniques employed in order to achieve the objectives outlined in this study. This research is conducted in two main phases. The first phase consists of fact finding through desk research, case study of past projects and semi-structured interviews to achieve Objective 1 and 2.

In order to achieve Objective 1 which is to ascertain the extent of pricing differences between tenders in building conservation works, the research question (RQ1) asked is "What is the variance of tender amount in conservation works?" The answer to this question will provide an insight into the degree of variance in the tender amount which the research is trying to ascertain. The methods employed to obtain the answer are by literature review and document analysis. Considering that the topic in question pertains to tender amount, the documents used in the analysis consists of tender documents for the conservation works. The tender amounts from different tenderers are analysed using comparative analysis method and coefficient of variation is used to determine the variance. The analysis of the data obtained will yield the answer for research question RQ1.

Objective 2 of this research is to identify the adequacy of tender documents currently used in building conservation tendering in terms of format and sufficiency of information to enable accurate cost estimating. Three research questions are asked to achieve this objective. The first question (RQ2) is "What are the reasons for the variance?" This question is a follow through from question RQ1. Upon determining the variance of tender amount, the next step is to find out the reasons for such variance in order to understand the phenomenon. The next question RQ3 is "How does

conservation process affect the pricing process?" As the subject of the research pertains to conservation, it is imperative to identify the effect of conservation process on the pricing, if there is any or no impact at all.

The final question RQ4 deals with suitability of the current BQ format for pricing with the following "Is the current BQ format suitable for pricing conservation works?" This question will help the research to identify the strength and weakness of the current BQ format in pricing for conservation works. The research will use the findings from these questions to identify the format and content of BQ that will aid contractors in pricing conservation works tender. The main method employed to obtain answers to these questions is semi-structured interviews with conservation contractors. Conservation contractors are chosen as the respondents as they are the party that is most affected by any conditions that influence pricing. The semi-structured interviews method is chosen because given the small numbers of conservation contractors in the country, quantitative method is not suitable as there will not be sufficient amount of data for quantitative analysis. Furthermore, this method is suitable for this research because there is also a need to probe respondents for unknowns in conservation works tendering due to the paucity of literature available. Answers for question RQ2, RQ3 and RQ4 are obtained from the data of the semi-structured interviews.

Table 1.1: Research structure

Research Objectives (RO)	Research Questions (RQ)	Methodology			
		Methods/ Activities	Instruments	Analytical Techniques	Analysis Results
RO1: To ascertain the extent of pricing differences between tenders in building conservation works.	RQ1: What is the variance of tender amount in conservation works?	Literature Review Document Analysis	Document Analysis: Tender documents for restoration works to heritage buildings	Desk Research Comparative Analysis Descriptive Statistics – Coefficient of Variation	Identification of elements that has high variance in price. Margin of variance.
RO2. To identify the adequacy of tender documents currently used in building conservation tendering in terms of format and sufficiency of information to enable accurate cost estimating.	RQ2: What are the reasons for the variance?	Interviews	Semi-structured Interviews – Conservation contractors	Thematic Analysis	Reasons for the high variance in price.
	RQ3: How does conservation process affect the pricing process?	Interviews	Semi-structured Interviews – Conservation contractors	Thematic Analysis	Reasons for the high variance in price.
	RQ4: Is the current BQ format suitable for pricing conservation works?	Interviews	Semi-structured Interviews – Conservation contractors	Thematic Analysis •Coding data •Detecting themes •Developing explanations •Generalising the findings to formulate framework	Format of tender documentation use for conservation project. Content of tender documentation use for conservation project.
RO3. To establish a guideline for the preparation of bills of quantities in building conservation works	RQ5: What is the format and content for bill of quantities that will enable contractors to price in a uniform and competitive manner for building conservation works tender?	Delphi Method	2-rounds Delphi method survey – QS and Architect with experience in conservation works	Descriptive Statistics – Measures of Central Tendency	Guideline on the content and format of BQ for conservation project.

The transcripts from the semi-structured interviews are analysed using thematic analysis method to elicit the themes from the interviews which will provide insights into the issues that are being researched. Results from the analyses succeeded in answering

the question RQ2, RQ3 and RQ4. Data and findings from the semi-structured interviews will be used to continue the study in next stage. The questionnaire used in the Delphi survey is designed based on the answers obtained for RQ2, RQ3 and RQ4. The main focus in this stage is to achieve the third objective which is to establish a guideline for the preparation of bills of quantities in building conservation works. The guidelines are to outline a suitable format and structure of information for bill of quantities that can adequately described the works involved in building conservation works to aid in the pricing of such tenders.

The research question to achieve this objective is "What is the format and content for bill of quantities that will enable contractors to price in a uniform and competitive manner for building conservation works tender?" The method employed in answering this question is the Delphi survey method. This method is chosen because it uses experts' consensus in the field of study to help draw out conclusion on the subject in question even though there are unknowns and uncertainty. As the proposed format and content of the BQ for conservation works could not be implemented in the industry during the research period, this method is used as a tool to validate the proposal. The experts chosen are from the profession of Quantity Surveying and Architecture that have prior experience in preparing BQ for conservation works. The Delphi survey is conducted in 2-rounds to reduce the attrition rate of the survey. The responses from the Delphi survey are analysed using the measure of central tendency to determine consensus of the panel of experts on each item in the questionnaire. The feedback from the Delphi survey is used to finalise the proposed content and format for conservation works BQ thus achieving Objective 3 of this research. The overall research process is also shown graphically in Figure 1.1 below.

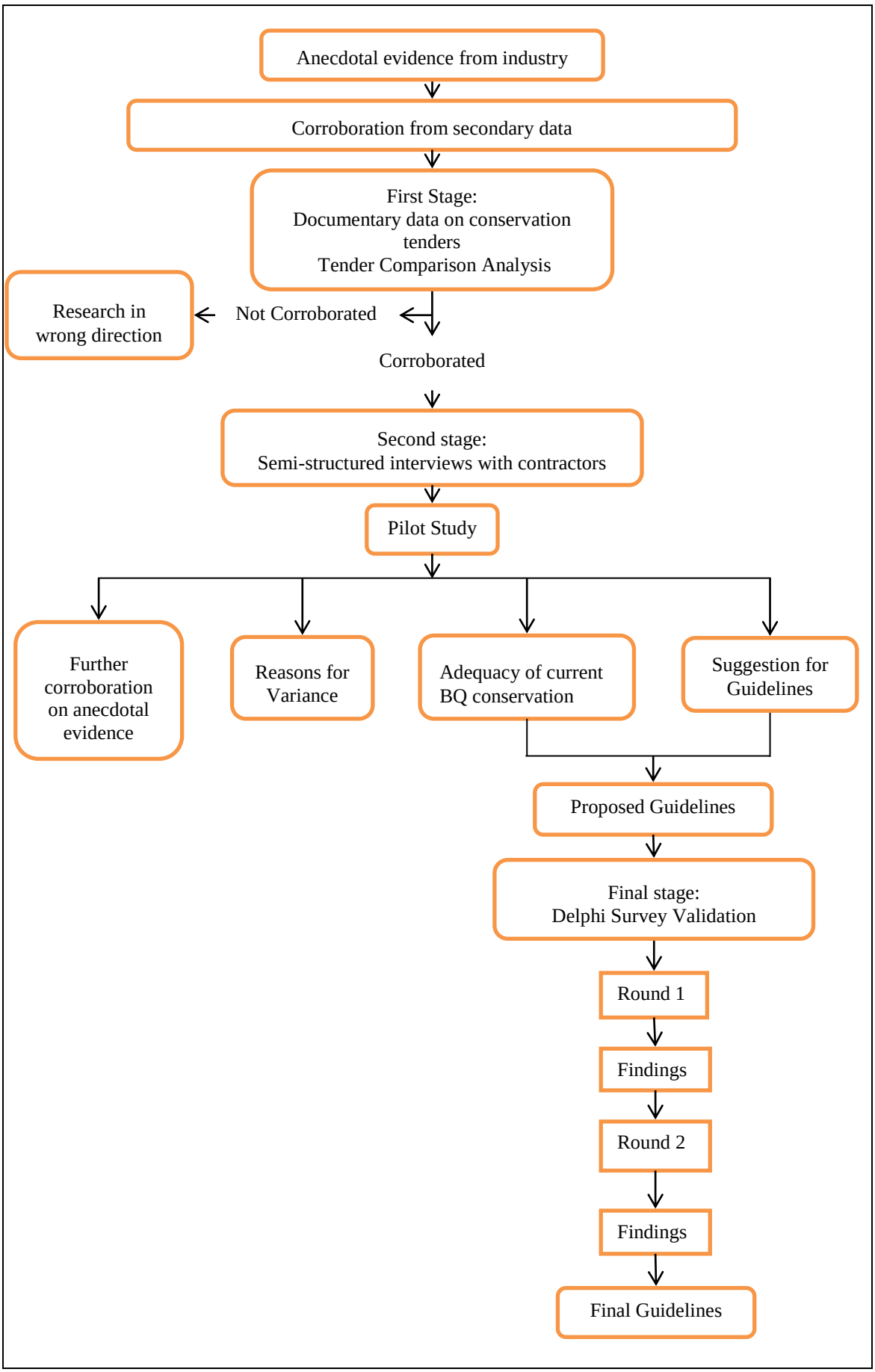

Figure 1.1: Flow chart of research process

1.5 Significance and Limitation of the Study

While the conservation process and procedures are widely researched, tenders and tendering process for conservation project are rarely so. While there are various studies on BQ for new works but research on BQ for conservation works is lacking as discussed in section 1.2 earlier and research in this area only started to gain interest due to the rise in the conservation activities in this country. As such, this research will provide a better understanding of the tender pricing for conservation works and the proposed guidelines for an improved bill of quantities that can be utilised by the industry players to enhance the competitiveness of the tenders for conservation projects.

However, there are still limitations to the research findings due to the factors below:

1. The available data and experts in this field are rather small due to the relatively recent interest to conserve and restore buildings. As the data needed are very specific and only respondents that have experience and knowledge in this field are interviewed, the pool of respondents to choose from is very limited.
2. The scope of the research is also limited to conservation tenders by public organisation. This is because tenders for private conservation projects are usually prepared according to the client's wishes and not necessarily will comply with the convention for conserving building. On the other hand, public conservation projects are usually more uniformed in format and comply with most of the conservation convention. This would provide the research with richer and deeper insights into tendering for conservation works but limited to public tenders.
3. Due to the uniqueness of each conservation projects, the proposed guidelines can only be used as a general rule and guide for the quantity surveyors during preparation of bill of quantities for conservation works. However, this is the

first step in the effort to provide the needed standardisation in BQ documentation that the conservation industry is currently lacking.

1.6 Outline of the Thesis

Chapter 1 outlines the background, rationale of the study as well as the aim and objectives conducted for this research. Problem statement of the research will also be discussed in this chapter providing an understanding of why this research on bill of quantities for conservation works is worthy to be studied and reasons for the need to find a solution for the issues highlighted. This chapter will also provide a summary of the research methodology explaining the reasons for using the selected methods and how the selected methods will achieve the research objectives and ultimately the research aim. The chapter will end with an outline of the thesis as a guide to the readers.

Chapter 2 explains and discusses the literature on the various areas relevant to this research. As tender pricing is part of cost estimating, discussion on cost estimates and factors affecting cost estimating is done at the start of this chapter. Tendering being the core area of this research necessitates discussions on tendering process and the factors affecting tendering in general as well as the specificities of tendering for conservation projects and the factors affecting tendering in this sub-sector of the construction industry. This chapter then proceeds to explain the definition, functions and contents of bill of quantities. The form and format of bill of quantities is also looked at. Taking into consideration that there exists tendering documents other than bill of quantities, a discussion on other types of documents that accompanied a bill of quantities is also included in this chapter. Further discussion on the adequacy of information that is available for tendering is also included here. As conservation is also the focus of this

research, definition of conservation, characteristics of conservation from the viewpoint of quantity surveying as well as the development of conservation in this country is included in this chapter.

Chapter 3 discusses the research design, data collection and data analysis methods that are employed in this research. The research perspective of this study as well as the research approach is discussed at the onset. This follows by the research methods employed for data collection which is document study, semi-structured interviews and Delphi survey method. This chapter will also explain the questionnaire design for both questionnaires of the semi-structured interviews and Delphi survey. Data analysis method used in this research is descriptive statistics employing the calculation of coefficient of variation for the tender variance part and the measures of central tendency for the Delphi survey. Thematic analysis is used to analyse data from the semi-structured interviews and this chapter ends with discussion on ensuring the validity and reliability of qualitative research.

Chapter 4 discusses about the data that is collected and the results from the analysis conducted. The chapter starts with data from the document study and analyse the data using coefficient of variation to determine the variance level of tenders in conservation projects. The analysis found that the level of variance for conservation works based on the collected data is higher than new build works. The reasons for the high variance are identified from the semi-structured interviews using thematic analysis on the transcribed text of the interviews. The findings reveal that hidden works, inexperience, bill of quantities and labour and material costs are the major reasons for the variance in tenders for conservation projects. The data from the semi-structured interviews are also analysed using the same thematic analysis method to determine the adequacy under the

theme of bill of quantities related inadequacies, specifications related inadequacies and other inadequacies. Findings on the adequacy of the BQ format and information for tendering are also discussed here.

Chapter 5 provides the validation of the proposed guidelines for a bill of quantities customized for conservation works. The proposed guidelines are formed based on the findings from the semi-structured interviews. The validation discussions are divided into four sections namely improvement to preliminaries bill, improvement to measured work bill, improvement to P.C. & Provisional Sum bill and documents other than bill of quantities. The discussions provide the validation from the expert panellists that participated in the Delphi survey on the proposed guidelines. The said guidelines are formulated as reference for the preparation of bill of quantities customized to the needs of conservation projects.

The concluding Chapter 6 summarises and highlights the achievement of the three objectives of the research. This chapter also highlights the outcome of the research which is the proposed guidelines for bill of quantities customized to the needs of conservation projects and concludes with recommendations for future research.

CHAPTER 2: TENDERING FOR BUILDING CONSERVATION

2.1 Introduction

This chapter reviews the literature on tender estimating as well as the factors that affect tender pricing. The discussion also touches on tender variance in conservation works, comparing the variance between new build and conservation works as well as looking at the factors that cause the variance. Expanding from the discussion on variance in the tender prices, the discussion also touches on the document that is used for pricing which is the Bills of Quantities (BQ) and its constituent parts. Considering that the research pertains to conservation works, it is also important to review other tendering documents that are relevant for conservation works tender such as Dilapidation Report, Historical Architectural Building Survey (HABS) and other related historical report. This chapter also discusses the characteristics of conservation works that is different from new build works.

2. 2 Introduction to Conservation

This section reviews the literature on building conservation focusing on the process of conservation and the similarities and differences between new build and conservation works. The special requirement for conservation works not found in new build construction works will also be reviewed in this chapter.

2.2.1 Definition of Building Conservation in this Study

Conservation usually means the preservation, protection or restoration of something, be it natural environment, natural ecosystem, wildlife, vegetation, culture, way of life, building, historical and cultural sites and even artefacts. However, in this study, the focus is on conservation of heritage building. The definition of building conservation

that is used in this research is based on the definition contained in the various international charters.

The Venice Charter 1965 was adopted by the International Council of Monument and Sites (ICOMOS) which enhance and enlarge the principles of conservation laid down in the Athens Charter of 1931. The Venice Charter provides guiding principles in the treatment of conservation and restorations of monuments and sites. These principles form the basis of good practices for conservation especially for building conservation. Both Charters provided manifestos on preservation of historic monuments and sites which are broad policies for countries to adopt within their own cultural framework.

For a more specific definition on conservation, the Australian Burra Charter 1999, Article 1.4 define conservation as means all the processes of looking after a place so as to retain its cultural significance. It includes maintenance and may according to circumstances include preservation, restoration, reconstruction and adaption and will be commonly a combination of more than one of these. It can be seen from the above definition that conservation of a heritage building is not only restricted to preserve a building but includes a combination of actions including even maintenance and for some type of heritage buildings allowing compatible use of the buildings.

In the local context, the National Heritage Act 2005 (Act 645) defines conservation as the following processes which are preservation, restoration, reconstruction, rehabilitation and adaptation or any combination of the processes mentioned. The definition of the each of the processes is also given in the same Act. In line with international definition, the local definition of conservation covers the whole spectrum of keeping the original state of heritage structure to adaptive reuse and even reproducing

a replica. Therefore, any construction works that involves any heritage structure would be considered as conservation works.

2.2.2 Stages of Work in Conservation Construction

The National Heritage Department on its website recommends five stages of work that must be adhered to in order to ensure that conservation work is implemented in a systematic and complete manner. Although the five stages involved works from pre-construction until post construction, works required in each of this stage must be reflected in the tender documents as the costs involved form parts of the total cost in conservation the building.

The works involved in the first stage pertains to the collection of historical, architectural, cultural and social significance of the building. Information on any repairs, upkeep and maintenance work carried out previously should also be collected and compile in the "Initial Survey" report. The second survey needed will be the technical "Dilapidation Survey". The comprehensiveness of the Dilapidation Survey Report will contribute to the quality of the tender document. Dilapidation survey is done to identify the condition of decay and damage of the building intended to be conserved. The important part in the dilapidation report is the suggestions of method of conservation to use to repair or restore the building. When the conservation methods are clearly listed, it acts as a guide for the quantity surveyor to present the information correctly in the tender documents. It will also enable the quantity surveyor to provide details sufficient for the tenderers to price instead of just providing vague description of works. During the dilapidation survey, scientific laboratory tests may be needed or proposed to provide further information on the condition of the building. The tests

required in future must be stated clearly so that the quantity surveyors can capture such needs and include it in the BQ.

The third stage of work advocated by the National Heritage Department is the preparation of tender documents for the bidding exercise. The said Department advocates discussions among the quantity surveyor, architect and conservation consultant to produce a better cost estimates for the proposed building. The Department also contribute the success of the conservation works to the tender preparation stage. This underpins the importance of the tender document in conservation works. As such, it is even more important now to ensure that a suitable and relevant tender documentation format is available for conservation projects.

Upon successful tendering, the next stage is the commencement of conservation works. During this stage, another important document must be produced which is the Historical Architectural and Building Survey report (HABS). This report contains the recording of the condition of the building before, during and after the conservation works. How this survey is done and the requirement must be relayed to the quantity surveyor so that it can be included in the tender document.

The final stage advocate by the National Heritage Department is the management and maintenance of heritage sites which is detailed in the Heritage Management Plan. The conservation of historical monuments does not just end in the repairing or restoration stage but also includes the care and maintenance and periodical improvement to the said monuments.

2.3 Building Conservation in Malaysia

Building conservation works in Malaysia has gained prominence since the joint inscription of the cities of George Town and Melaka as World Heritage Cities in 2008. The areas of historical cities are divided into core and buffer zones. Both core and buffer zones adopt different principals and guidance to be followed in preserving or conserving the heritage buildings. Historic buildings are divided into two categories, namely category 1 and category 2. Category 1 buildings are defined as building with high architectural and historical values which are not allowed to be demolished, altered and extended except restored. Category 2 buildings are defined as buildings with architectural values which are allowed to be renovated for adaptive re-use. Differences between these two categories of buildings are the eligibility of the heritage building to be demolished, altered, extended and renovated to be re-use adaptively.

The increased conservation activities not only benefitted the preservation of culture and history of the cities but also promoted the growth in the conservation sub-sector of the construction industry. However, as conservation activities increased only fairly recently, the industry felt an acute lack of established procedures in the management of the conservation construction activities. The issues span a wide spectrum, from technical knowledge in conservation methods and materials to budgeting and cost management. Due to the wide ranging issues, the scope of this study is limited only to the cost management aspect, specifically variability of tender bids for conservation works.

Within the construction industry, conservation projects are perceived to be significantly riskier than new building construction (Mansfield & Reyers, 2000) mostly because building conservation project typically demands a non-standard scope of works

and uses a different approach (Ahuja & Campbell, 1988) as well as needing special project management experience. Conservation works in this study is defined as work on historic or heritage buildings that comprises preservation, refurbishment, rehabilitation, maintenance, restoration, reconstruction, repair and adaptive reuse (ICOMOS, 1995; ICOMOS, 1999; Dann and Wood, 2004; Bullen, 2007).

Although conservation works are considered as part of the construction sector, there are clear differences between new build works and conservation works due to the different methods and processes involved during conservation and restoration. In looking for similarity with new build work, it is found that conservation works are similar to refurbishment where work consists of small labour intensive operations scattered throughout existing buildings (Quah 1992).

In any building conservation project, one of the main concerns is the cost of restoration. Owners perceive that conserving a building would cost higher than building a new one. Their concerns may not be far off as the capital cost of restoration could be higher due to the types of construction method as well as the costs of labour and materials (Brandon, 1982). In addition, Dann and Wood (2004) found that conservation of historic buildings requires additional layers of bureaucratic approval and perceived costs that constitute burdens on the clients and building contractors.

In the cost management of conservation works, the quantity surveyor's skill is called for. The role of quantity surveyor in construction project ranges from cost estimating to cost control and management. In dealing with the costing part of the project, the quantity surveyor would have to produce requisite documents to determine the cost as well as for cost management. The most important document is the bill of quantities

(BQ) document and this BQ forms an integral part of the tender documents. The quantity surveyor must be familiar with the full range of works and consider the construction methods, restoration techniques as well as work sequences to be able to produce a good bill of quantities.

However, due to the lack of experience and knowledge in managing conservation projects, the industry is currently faced with BQ documents that have caused a wide variance in the tender amount of the tenderers. The margin of differences between tenderers of 22% is seen to be above the norm in the industry, which is in the range of 5% -10%. This problem causes difficulty during the assessment of tenders and selection of successful bid especially when the BQ produced is vague and contains "all-embracing" clauses to cover the vagaries of conservation works.

2.4 Issues in Tendering for Conservation of Building

This study arises out of the need to know and to have a deeper understanding regarding tendering for conservation works. Although data on construction cost and tendering is abundant but it is mostly on new build works. While conservation projects are increasing day by day, the same cannot be said for research on this area. The knowledge and data on new build works may not be applicable to conservation works as the process of conserving a heritage building differs from constructing a new building. One of the main differences is the sequence of work where it is a top down approach for conservation works (Lee & Lim, 2009) as compared to bottom up for new build. As the building is already an existing structure, conservation works do not require structural construction like in new build. Instead structural repair works may be needed depending on the condition of the building. Restoration usually begins at the roof then proceeds to the internal areas, windows, doors and external façade. Due to the repair

works on the roof, temporary roof covering is an important item for conservation works while there is no such need for new build works.

While conservation works has different characteristic from new build, it has similarity to refurbishment works (Quah, 1992) such as it consists of small labour intensive operations where the works are scattered throughout the existing building. There is also a lack of as-built drawings to guide designer and builder. In addition to that, sometimes the extent of work is not discovered until demounting work has commenced. All these characteristics create difficulty in the planning and estimating works due to the unknowns and uncertainty (Egbu, 1995) in the extent of repair works needed. Such uncertainty does not occur in new build works as the scope and extent of work is clearly demarcated. Similar to refurbishment, conservation works are also carried out in a confined site, sometimes in a dilapidated and run-down condition that creates a challenging and difficult working environment as compared to new build works (Lee & Egbu, 2006).

Another challenging feature in conservation works is the need to use original materials where possible or at the least to match the existing material and design. This is especially important for first grade heritage building restoration and thus the contractor will need to source for original materials or custom order for those out of production materials. Very often, such materials have to be sourced overseas like in Indonesia or Vietnam where there still exists local craftsmen producing materials such as traditional roof and floor tiles. Not only is the sourcing of materials difficult, the need for workmen is also very specialised and certain type of skilled workmen are needed to perform the work especially decorative work that is no longer used in modern construction. Frequently, local craftsmen are no longer available and the contractor will

have to source such craftsmen from overseas. For example, many conservation works on Chinese temples in this country uses skilled craftsmen sourced from China. This requirement has cost implication which is difficult for the contractors to estimate at the tendering stage and also requires the contractor to have sufficient experience to be able to foresee this problem.

Other requirement that has cost implication for conservation works pertains to the need for special type of tests (Lee, 2009) to be performed in the early stages of work to provide a reference to the conservator and contractor on the condition of the building as well as for selection of materials and construction method. In addition, conservation convention also requires historical studies to be conducted pertaining to the building before commencement of work. The cost for such study varies rather substantially and is dependent on the client's requirements. Understanding that construction work for new build and conservation differs in terms of work approaches, works sequence, use of materials and labours and the availability of information and drawings, conventional approaches used for new build may not be suitable for conservation works.

Unlike new build where drawings are available for each part of the building, conservation works may not have such luxury especially if the building is very old and the as-built drawings are missing. As such, without drawings, it is difficult for the conservator or contractor to be able to visualise the restoration works needed during the tendering period. In the event, there is a need to produce measured drawings; the additional requirement will incur extra cost to the entire works. As the full extent of work cannot be determine during the tender period, contractors will usually mark-up the tender according to their own assumption of the works that may be needed in addition to the items listed in the tender document.

As such, it can be seen that construction work for new build and conservation differs in terms of work approaches, works sequence, use of materials and labours and the availability of information and drawings. Considering the differences between new build and conservation works, conventional approaches used for new build may not be suitable for conservation works and so it is important to identify and understand the factors that affect the variability in estimating cost for conservation works.

2.5 Cost Estimate

Regardless of whether the project is new build or conserving a heritage building, an estimate of the cost is needed before commencement of work. Without this estimate of cost, the client would not know the cost of his project and at what price can he award the contract to the contractor. Estimating is the process of pricing work based on the information/specification and/or drawings available in preparation of submitting an offer to carry out the work for a specified sum of money which is known as tender sum (Buchan, Fleming, & Grant, 2003).

Cost estimate can be done at various stages of a project i.e. from pre-contract to post contract stages. The purpose of estimating the cost of work at different stages of work is not the same. Hendrickson (2000) explains that cost estimates can be classified into three types which are design estimate, bid estimate and control estimate. Design estimate is done during the design stage of the project and are usually known as preliminary estimates. At the early design stage, cost estimates are usually ballpark figures type of estimates graduating to cost estimates with more details as design information increases. Bid estimate is done for competitive bidding or tendering and is usually based on the information in the tender document in combination with the contractor's construction procedures, subcontractor quotations and a mark-up. Control

estimates are established for monitoring the finances of the project during construction (Hendrickson, 2000).

Studies on cost estimates usually centres on the accuracy of estimating as well as the variables and factors affecting cost estimates at pre-tender stage. Onukwube (as cited in Alumbugu, Ola-awo, Saidu, Mustapha & Abdulmumin, 2014) in his study identified 15 factors that influences tender prices which are volume of building projects with back up finance, degree of competition among contractors, project definition, contracting plan, type of development, labour productivity, material availability, contract types, location/site conditions, management ability, zonal rates, category of contractor, level of profit, level of workmanship and government policy.

Procurement method was not found to be one of the factors that influence tender prices in the above study. However, comparisons study done by Blanc-Brude. Goldsmith &Valila (2009) found that construction of roads is 24% more expensive by Public Private Partnership procurement than traditionally procured. Theoretically the reasons for the higher cost are due to bundling of construction and operation into one contract that may generate additional upfront investment, construction risk transfer to the private partner, and even the recouping of higher transaction costs. In addition, the study found that the higher cost are also due to the price that the public sector pays in order to avoid cost and time overruns as well as specification changes.

Another study by Pasquire and Collins (1997) found that there may be huge costs concealed within the tendering processes for design and build procurement as compared to traditional procurement due to abortive tendering costs for contractors. As such, this indicates that the contractor may include such abortive costs into the tender price.

The above studies contradict the standard criticism of traditional procurement where the cost would be higher due to separation of design and construction. However, Goodchild and Chamberlain (1999) also clarify that price differences may be evened out by the tendering climate. They explained that contractors are aware of the going rate for a project and adjust their price accordingly. As such, traditional procurement provides the clients with cost certainty at the onset of the project.

In estimating the cost of a proposed building, the main resources taken into calculation are labour, plant and material. Labour would include both skilled and unskilled workers. The rates for each type of labour would be quite standard in the industry and each tenderer would need to list out the labour rate in the Schedule of Daywork Rates. Rates for plant are also treated similar as labour where the rate of each plant will also be listed in the Schedule of Plant Rates. Materials would be priced according to the supply rate plus allowance for delivery, storage and wastages. In addition to the main cost of labour, plant and material, there is also an addition of overhead cost and profit by the tenderer to arrive at the final tender sum.

2.6 Variability in Cost Estimating

The cost of a construction project does not only depend on a single factor but is influenced by a number of variables. Various studies have been conducted in the last 15 years to identify the factors that influences cost estimating in the hope of finding a more accurate method to estimate construction cost.

Early studies found several factors that influence the variability of cost estimates. Skitmore (1982) identified three factors which are inherent unpredictability, uncertainty and costing errors. Unpredictability refers to conditions beyond the control of the

contractor such as site and weather conditions. According to Skitmore (1982), uncertainty is caused by incomplete design as well as unknown future cost levels. Other than the above factors, estimators will also allow different contingency values according to their perception and attitude of the level of risk involved and because the knowledge of each tenderer is different, thus the allowance will not be the same. Variability also occurred due to different mark-up policies of the tenderers.

Recent study by Alumbugu et al. (2014) identified 10 significant factors that affect the accuracy of pre-tender estimate as follows.

1. Experience and skill level of the consultants,
2. Project teams experience on the construction type,
3. Clear and detail drawings and specification,
4. Completeness of cost information,
5. Accuracy and reliability of cost information,
6. Availability of all fields of specialization in a project team,
7. Quality of information and flow requirement,
8. Clear scope definition for the client,
9. Financial capability of the client, and
10. Completeness of project documents.

Out of the above ten factors, Alumbugu et al. (2014) explains that the factor that has the most influence on accuracy of the pre-tender estimate is the experience and skill level of the estimator. Information seems to be an important factor as well where the attributes of clear, complete, accurate and reliable will influence the accuracy. Needless to say, the positive side of these attributes will increase the accuracy and vice versa.

Variability of the cost estimates is considered by Beeston (1983) to be the major component of tender variability. The effect of subcontracting is also a factor considered by Flanagan and Norman (1985) to cause tender variability. They reasoned that it is due to main contractors employing different subcontractors and splitting the contract into various subcontracted work packages for different contracts.

The tendering process requires multiple inputs of information from various sources for the calculation of the tender amount. Bentley (1987) summarises the tender activities into four main activities of 'decision to tender', 'collection of information', 'preparation of estimate' and 'the tender submission'. Under each main activities, there are further sub-activities, all in totalling 26 sub-activities to be performed before the tender is ready for submission. Due to the complicated process of pricing the tender, it is inevitable that there are both external and internal factors that will influence the pricing level of each tender. At the very fundamental, the tender amount consists of the cost estimate of the building plus a margin for overheads and profits (Smith, 1986). The margin is usually a percentage mark-up to the cost estimate. The percentage mark-up decided upon by each tenderer will be dependent on the firm's mark-up policies. The decision on which mark-up policy to adopt depends on various factors. One of which is bidding strategies (Fine, 1975) where the mark-up policy will depend on whether the tenderer is embarking on a random tendering when work is low, selective tendering or a severely competitive bidding. Workmanship standard is suggested by Stone (1983) as one factor that influences the mark-up policies. If a firm lowers their standard of work, differentiation of cost with other tenderers will occur. Other factors include profitability, market conditions as well as contract conditions (Upson, 1987).

2.7 Tendering in Building Conservation Works

The BQ document forms one of the most important documents in the construction process. It provides a common basis for the comparison of bids (Kodikara et al. 1993) so that the client could obtain the most competitive tender. Nevertheless, the current practice of BQ production for conservation works is not standardized and BQ are produced according to each consultant own style. This causes problems during the tendering, awarding as well as the administration stage of the conservation works. During tendering stage, contractor faces problem in pricing due to the various lump-sum items and provisional sum used in the bill of quantities.

Due to the many unforeseen work in conservation, tenderers are not sure of the extent of work and thus large difference in the tender amount occurs between tenders. The nature of such work is difficult to predict in terms of final content, extent and specification (Smith, 2005). This in turn causes difficulty during the awarding process as the large price difference makes it difficult to determine which tender amount is the most competitive. If the client awards the contract to the lowest tenderer, this raises the question whether the tender is under-priced but awarding to the higher tenderer would be difficult to justify. Al-Khaldi (1990) study (as cited in Alumbugu et al., 2014) found that it is the norm for tenderer that submits the lowest tender often wins the contract but then the tender amount cannot be too low that it might cause losses to the contractor.

Problems due to the vagueness of the BQ do not end after the award of the tender. During the construction phase, description that is not clear or “all-embracing”, missing items and provisional items may cause cost and time claims. A study by Quah (1992) on refurbishment works found that complaints by contractors focused on format and variability of tender documents especially on poor work descriptions, obscurity of

specification clauses, amendments to Standard Forms of Contract and the Method of Measurement. The same study also found that inadequacies was covered by using "all embracing" risk clauses in the tender documents. This created higher risks and tenderers that perceive the level of risks differently will mark-up differently thus creating a big variance between tenders.

Similarly, in the local context, Lee (2009) found fourteen (14) issues concerning tender documents for conservation works and out of the fourteen (14) issues, six issues pertain to the bill of quantities. The six issues are as follows.

1. Accuracy of quantities is affected due to lack of details/drawings.
2. Complex work description in BQ is confusing.
3. Descriptions in BQ are incomplete or unclear when compared to actual work done on site.
4. Contractor encounters incomplete detail and information in BQ and tender document.
5. Insufficient details are caused by unforeseen works.
6. Non-standardised format and arrangement of BQ.

The problem lies in the different sequence of work, the need for specialist work and different specification required for building conservation as compared to new building works. Other than the above, other problems encountered included lack of drawings to guide contractors as well as the extent and problems of the works are not usually discovered until site work commences (Quah 1991).

The competitiveness and accuracy of the bid price depends very much on the quality of the BQ. Missing items in the BQ documents will incur cost claims during the

construction period. Substantial cost claims will cause an increase in the total construction cost and this budget overrun poses financial problems to the client. Currently, bills of quantities prepared for conservation works do not follow any standard template or guidelines specifically cater for conservation works. Each consultant prepares the document according to the firm own house style. As such, there exist in the industry various styles of bill of quantities which confuses the contractors as well as the consultant team. This is because some BQ are prepared in detail, some in lump-sum while some uses provisional sum liberally. A study by (Quah 1992) also found that refurbishment tenders have a higher provisional sum contents. This has caused a high discrepancy between the tender prices among tenderers as well as cost over-runs during the construction period.

Therefore, it is insufficient to prepare BQ for conservation work by merely adapting standard documents for new building works which do not reflect the actual needs and special processes involved in conservation work. This approach does not work well as can be seen from the findings in the study by Lee (2009). Lip (2011) also states that traditional bills of quantities prepared strictly in accordance with the standard method of measurement is ideal for new build work but may be inappropriate for refurbishment works.

Odeyinka and Perera (2009) found that the differences between the final account and BQ amount vary among different type of projects. In their study, they found a deviation of -3% to 4% between final account and BQ amount for housing projects while the deviation on educational projects was between -4% and 17% and for commercial project, it came out to be between -20% and 20%. In the case of refurbishment projects, a deviation of between -11% and 37% was obtained. Thus they concluded that the more

complex the project, the less reliable is the BQ as a budgetary tool. However, there is a need to find out the reasons for this phenomenon, whether the differences are due to the inherent BQ form or the use of incorrect format.

Kodikara et al. (1993) found that in order to use the data in a BQ, 50% of the BQ requires some form of re-working, i.e. modification or breaking up of data when the data is being used. This shows that the format of BQ needs to be improved to enable more efficient use of data for estimating. They go on to suggest that the information stored in the BQ should be arranged in a directly useable way and it was found that, 'quantities', 'quantity units', and 'unit rates' are the key elements of the BQ information that need to be presented in a more meaningful format.

2.8 Variance in Tendering

Factors influencing variability highlighted in the literature includes cost estimates (Skitmore, 1992), errors in pricing (Skitmore, 1982), differences in cost estimates (Beeston, 1983), mark-up policies (Stone, 1983), serious and non-serious bids (Skitmore, 1989), contract type and size (Drew & Skitmore, 1997).

Buchan et.al (2003) explains that variability in a tender may also be due to the following reasons.

1. Items of responsibility – the estimator would take into consideration the need of the project such as compliance with quality control provisions and work carried out under abnormal conditions. The estimator will also study the specifications, preliminaries and conditions of contract in addition to the plans and BQ. As such different estimator would interpret and allow the cost differently.

2. Quantities – when the quantities are provisional or not given, this will give room for variability in the measurement of the quantities which will affect the final cost.

3. Material cost – different tenderers will receive different discounts from suppliers depending on their business size and relationship. This difference in savings will be reflected in the pricing of the items of work. Allowance of different costs to storage and wastage will also affect variability in the pricing.

4. Method of construction – Buchan et.al (2003) mentioned that this is a major factor in the variability of estimators' price. The method of construction used will have an impact on the labour and plant costs which will influence the final costs of the item of work.

5. Labour cost and productivity – labour costs is dependent on the unit rate of labour as well as the productivity of the labourers. The higher the productivity, the lower the unit costs. However, productivity rate has wide differences between projects, assumptions and labour constants used.

6. Plant cost and productivity – plant costs would encounter the same problem as labour cost.

7. Site conditions – if site conditions information is not fully available to estimators, this can affect the pricing. If the estimator did not note site constraints such as site access, a low estimate may be produced.

8. Location – location of the site can affect the cost of materials due to higher transportation costs.

9. Escalation factors – if the contract will be a firm priced contract, the estimator will make an allowance for increasing costs and this allowance would be different between estimators.

10. Contract time – the contract time will affect the variability in the work method used by different tenderers. This will occur in tenders where there is performance specification or where construction period is to be offered by the tenderers.

11. Overhead and profit – this is also perceived to be an area of high variability because different tenderers would mark-up differently for overhead and profit depending on their tender strategy.

12. Contingency – Tenderers may include contingency to cover unforeseen costs and the mark-up is arbitrary depending on the tenderers calculation of risk.

13. Cash flow and financing – Tenderers may include financing charges to the tender sum to cover for overdraft charges during construction period as the payment from the client are usually in arrears with a retention of up to 5%.

14. Errors – Errors in pricing the tender is also one of the factors contributing to variability in the tender amount.

2.9 Adequacy of Information for Tendering

In order to achieve quality estimating, adequate and accurate information is indispensable. For the purpose of tender pricing, important information needed is drawings, specifications and BQ. If the tenderers have enough information, he can avoid guesswork, include all important items in his tender and will not need to add global sum for poorly defined elements of work (Brook, 2008). As such, adequacy is seen as whether a tenderer must make additional allowance in order to make use of the information (Skinner, 1979).

In additional to providing information for tendering, a BQ is also devised to be a tool that affords a fair basis of comparison of tenders for the purpose of contractor selection (Skinner, 1979). When a BQ could not afford such fair comparison in a tender exercise,

a review should be conducted on the BQ to pinpoint the deficiency and to find a way to rectify the shortcoming of the BQ. The ability of the BQ to provide a fair basis in selecting contractor in new build work is reliable thus far as the BQ provides a standard document for pricing so that competing tenderers are unlikely to interpret the document significantly different (Skinner, 1979). As such, the tenders could be compared on an "apple to apple" basis because each competing tenderer would have the same information. When the details in the BQ are adequate, tenderers would not need to make assumptions to price.

2.9.1 Adequacy of Format Presented in BQ

The importance of the measured work bill is not only because it contained the largest amount of information but also where the unit rates are inserted for the items of work (Skinner, 1979). A study by Skinner (1979) found that while the format of the units of measurement are suitable for pricing, it is seen to be inadequate due to the lack of information on the location of the work. He further suggest supplementary information be attached to the quantities to mitigate the inadequacies but he did not state which type of information. The same study also found that descriptions of work are both suitable in format and adequate. This finding is important because description in a BQ is the starting point for a tenderer to understand and comprehend information pertaining to the required work before arriving at a unit rate (Bandi, 2011).

However, Skinner (1979) found that the P.C. and Provisional Sum section appears to be inadequate. The inadequacies of the P.C. and Provisional Sum sections pertains to the format of the items which is lacking in identifying factors which are significant to the contractor's cost, therefore causing difficulties in estimating the cost that is related to the P.C. and Provisional Sum works.

2.9.2 Adequacy of Information Presented in BQ

The study by Skinner (1979) also found that preliminaries to be generally adequate for tendering except for two areas which are inadequate for pricing. The first is the details describing the site and its location and the second are the statutory details required. Demolition works are also seen to be adequate for pricing but not for work planning because there is missing information on the method of work.

Although description and unit of measurement format are acceptable for tendering purpose, it is found to be inadequate in the way it is presented (Skinner, 1979). Prime Cost Sum is also found to be inadequate in terms of the format as well as the information provided in that section. Skinner (1979) opined that there is no benefit in presenting work in the format of prime cost sum and this practice should be reviewed.

The inadequacies mentioned above pertain to the details in the descriptions. When information is not sufficient, it is difficult for the estimator to know the exact work required. In order to submit the bid on time, the estimator would have no choice but to make an assumption and since different estimator would make different assumptions, this inadequacies will defeat the objective of the BQ which is to enable all competing tenderers to obtain the same factual information for pricing. Therefore, the descriptions should be detail and not just rely on specifications as reference for the estimator because the estimators need more than an abbreviated description to price accurately (Brook, 2008).

Greatest constraints identified against adequate management of construction cost information are with respect to insufficient design information, unavailability of

relevant database and fluctuating construction input prices (Akintoye, Ajewole & Olomolaiye, 1992).

2.10 Definition of BQ

At the outset of this research, the definition of BQ must be clearly defined. In practice, oftentimes the term tender document and BQ are used interchangeably but this is not correct. Tender document is a document comprises of many different parts compiled together for use in a tender exercise. A tender document consists of different sections where BQ forms one of the sections.

The sections commonly found in a tender document are as follows.

1. Instruction to Tenderers
2. Form of Tender
3. Conditions of Tendering
4. Standard Specifications
5. Preambles to all Trades
6. Bills of Quantities/Schedule of Works
7. Final Summary
8. Appendices

The traditional purpose of BQ is to act as a uniform basis for inviting competitive tenders and to assist in valuing completed work. In addition to the BQ, other important sections in a tender document that provide important information required for pricing is the Standard Specifications and Preambles to all Trade sections. Method statements are written descriptions of how items of work will be carried out in terms of the use of labour and plant (Ashworth & Hogg, 2007). Method statements are not part of the

tender document although it can be included. The current practice is for the contractor to produce the method statement and submit to the Architect or Engineer for their approval. This practice is common and provides the contractor the chance to propose construction method that is the most cost and time effective. However, if the client required that construction be done strictly in accordance with certain policies or guidelines, method statements to that effect can be included in the tender documents or alternatively be spelled out clearly in the specifications.

Atkin (1995) described BQ as a type of technical information setting down various items of work in logical and recognized sequence ready for pricing. It is also regarded as an important output that represents information produced in the design phase of a project (Kwakye, 1997). A BQ contains numerical and structured textual information to fully and accurately describe a project (Fryer, Egbu, Ellis, & Gorse, 2004).

In dealing with the costing part of the project, the quantity surveyor would have to produce requisite documents to determine the cost as well as for cost management. The most important document is the tender document which consists of Instruction to Tenderers, Form of Tender, Conditions of Tendering, Standard Specification, Preambles to all Trades, Bills of Quantities/ Schedule of Works, Final Summary and Appendices. In all of the above sections, the BQ is the most critical as this section contains the cost of the project. A Bills of Quantities is an important form of information that itemises the work needed to construct the proposed building (Kwakye, 1997; Davis and Baccarini, 2002). Ashworth and Hogg (2007) detailed it further by explaining that a BQ is made up of a list of works to be carried out presented in a schedule with brief description of the works and the quantities of the works proposed.

In order to produce a good bill of quantities, the quantity surveyor must have knowledge in the full range of works as well as the construction methods. In the case of conservation projects, there is the need for additional knowledge on restoration techniques as well as the proper conservation work sequences that must be acquire so that the quantity surveyor could prepare useful information in the BQ which is relevant to the proposed works. Hackett, Robinson, and Statham (2006) purport that inclusion of necessary information with details will assists tenderers and project participants to function more effectively.

2.11 Historical Development of BQ

Although the bills of quantities has been in use since the 1830s with its formal debut in 1834 in the United Kingdom for the construction of the Houses of Parliament (Skinner, 1979), its use was not common in South East Asia prior to World War Two. In this part of the region, the first major bills of quantities only debuted in 1937 for the Supreme Court building in Singapore (McDonald & Singha Rajah, 1975).

During the reconstruction after World War Two, the quantity surveying profession continues to establish itself and the BQ which is one of the major tools of a quantity surveyor would also follow suit. However, at that time, the practice is limited to either an extension of the activities of firms operating in the United Kingdom or by the government (McDonald & Singha Rajah, 1975). The first Standard Method of Measurement was produced in 1960 by the Malaya Branch of the Royal Institution of Chartered Surveyors (RICS) for use in the Federation of Malaya, Singapore and Borneo.

Ever since then bills of quantities are commonly used to obtain an estimate of construction cost before the commencement of a construction project. As traditional procurement is popular in the construction industry in this country, bills of quantities is one of the main documents used in the tendering process.

2.12 Framework of BQ

The documentation format of BQ used locally is adopted from the UK system. However as the local Standard Method of Measurement is different from the UK Standard Method of Measurement, the format of BQ is also adapted to suit local requirement. Nevertheless, the main purpose of the BQ is still the same, which is to allow all tenderers to make their offer based on the same basis during tendering. A well prepared BQ would enable the tenderers to understand the scope of work involved and thus would also enable the tenderer to price accurately what the work would cost.

According to Pasquire and McCaffer (1988) (as cited in Kodikara, et al., 1993), BQ can be categorised into three main sections which are Preliminaries, Preambles and Bills. Brook (2008) divides BQ into four sections which are Preliminaries, Preambles, Measured Works and Prime Cost and Provisional Sums. However, in the local practice, the Preambles section is included as part of the tender document but not as part of the BQ. The bill of quantities usually consists of several separate parts which are called Bill in general. The different bill usually found are Preliminaries, Prime Cost and Provisional Sum, Main Building Works and other works that are not included in any of the earlier bills. Although there is no fixed rule that require the bill of quantities to follow the sequence above, it is a common industry practice to do so and using the above sequence would allow a tenderer to quickly understand the document and easily find the important bills for their bid calculation. Although all bills formed part of the

BQ, the format for the Preliminaries, Prime Cost and Provisional Sum and Main Building Works are different from each other.

2.12.1 Preliminaries Bill

The preliminaries bill covers all items that are related and necessary for the construction of the building but not forming part of the building itself. Section B of the Malaysian Standard Method of Measurement of Building Works 2nd Edition (SMM2), has identified the following items to be included in the preliminaries bill:

1. Name of project, parties and consultants.
2. Description of the site.
3. List of drawings and other documents.
4. The form, type and conditions of contract.
5. Contractor's liability and the need for insurance.
6. Employer's liability.
7. Obligations and restrictions imposed by the employer, e.g., access to site, limitations of working space, maintenance of existing services, temporary accommodation and facilities and etc.
8. Works by nominated sub-contractors, type of attendance to be given to nominated sub-contractor, builder's work in connection with work by nominated sub-contractor and etc.
9. Goods and materials from nominated suppliers.
10. Works by government and statutory authorities.
11. Works or goods and materials by the employer.
12. General facilities and obligations to be provided by the contractor such as plant, tools and vehicle, scaffolding, temporary roads, temporary services, safety, health and welfare for the workpeople and etc.

13. Contingencies.

The preliminaries section should also contain special works that are needed for the construction and completion of the project. In the case of conservation works, it must include procedures that are required for conservation works on a building as stipulated by the local authority or conservation practice guidelines. This is to ensure that the costs are included in the tender amount and would reflect the true cost of the whole project. Unfortunately, the most items in the preliminaries are difficult to quantify, and as such, the bill only contains two columns, one for the description of the items and another for the tenderer to price a lump sum amount for the items.

2.12.2 Prime Cost and Provisional Sum Bill

Prime cost sum is defined in the SMM2 as a sum provided for work or services to be executed by a nominated sub-contractor, a government or a statutory authority or for materials or goods to be obtained from a nominated supplier. This means that, if any part of the work is to be awarded as nominated sub-contract work, it will not be included in the building works bill of quantities. In order to ensure that the cost is included in the tender sum so that the tender sum reflects the total construction cost the nominated sub-contract work is included as a prime cost sum and shown in the prime cost and provisional sum bill. As the tender amount is the sum of all the bills, the cost of the nominated sub-contract work will be included in the total tender sum. For this section, the quantity surveyor has to estimate the cost of the nominated subcontract works and state the amount in the bill. No quantity is given.

SMM2 has also defined clearly provisional sum as a sum provided for work or for costs which cannot entirely be foreseen, defined or detailed at the time the tender

documents are issued. This is one method to ensure that the cost of work that could not be confirmed or did not have sufficient details during the tender stage are included the tender amount. While prime cost sum is for works that will be awarded as nominated sub-contract work in the future, provisional sum is for works that may or may not be a nominated sub-contract work later. Items given as provisional sum can also be included in the building works after the award of the tender, i.e. during the construction stage.

2.12.3 Measured Works Bill

This bill contains the details of construction/conservation works that is needed for the project. This section is usually written in a tabular format containing the following information.

1. Complete and clear description of the item of work.
2. The unit of measurement.
3. The quantity of the item of work.
4. Column for insertion of the price.
5. Column for the total amount for each item of work.

As improvement to the BQ, SMM7 recommends several good practices for bill formats as follow (Brook, 2008).

1. Separate buildings should be in separate bills.
2. External works should be given in separate bills.
3. Provisional sums, prime cost sums and dayworks should form a separate section at the end of the measured works. Provisional sum inserted in the Preliminaries bill cause a great deal of confusion and can be missed by an estimator.
4. Summary should be at the end of the BQ.

The SMM2 Practice Manual explains that the general format and design of bill of quantities is left to the discretion of the QS. Although there is no particular standard format in the construction industry but most BQ would be rather similar and follows the style suggested above. This is true for all types of construction works regardless whether it is for new build or conservation works or refurbishment.

Due to the details involved in this bill, the works can be priced rather accurately. However, if "all-embracing" descriptions are use in the BQ, such descriptions could make pricing inaccurate even for new build works BQ. In addition, for works that are perceived to have higher risks, an allowance is usually included in the tender by way of higher mark-up (Quah 1992).

2.12.4 Standard Method of Measurement (SMM)

The standard method of measurement is a measurement code to provide guidance to the quantity surveyors when performing measurement for the preparation of BQ. Having a standard method of measurement ensures that all stakeholders in the construction industry agreed and understand how each quantity is derived and thus will ensure uniformity in calculating the quantities and standardisation in the format of BQ for use in the industry.

The Malaysian Standard Method of Measurement of Building Works by the Royal Institution of Surveyors Malaysia is now in the second edition. The first edition was published in 1959 which was for use in the Federation of Malaya, Singapore and Borneo. This first edition adopted the UK Standard Method of Measurement of Building Works by The Royal Institution of Chartered Surveyors as the basis for the document with modifications to suit the demands of local practice and condition.

Subsequently, in 1979 the first edition SMM was converted to the metric edition in line with the adoption of metric system in Malaysia.

Due to the various changes and innovations in methods and modes of construction since the 1960s when the first edition of SMM was produced, there is a need for the SMM to be revised to reflect the changes in the construction industry. The SMM being a tool to communicate quantities and cost control needs to be updated to allow for better management and effective monitoring of the works (Royal Institution of Surveyors Malaysia, 2000). As such, in 2000 the Malaysian Standard Method of Measurement of Building Works Second Edition (SMM2) was published to fulfil this need.

The SMM2 contains rules for measuring building works, coverage, definition and description format to be used as a basis for the preparation of BQ to obtain a tender price. The rules address all aspects of bill of quantities production, including quantification of work items as well as guidance on the content, structure and format of BQ. While the SMM2 states that the standards apply equally to both proposed and executed works, its focus is on new building works. It does not cover civil engineering works which has a different standard measurement codes i.e. the Malaysian Civil Engineering Standard Method of Measurement 2011 as the basis for preparing BQ for civil works.

2.12.5 International Standard Method of Measurement

Considering that the outcome of this research pertains to the rules and guidelines similar to SMM, it is essential that SMM of other countries are analysed to provide a wider context of discussion that includes the international context and to learn from

other countries' experiences. Malaysia as member of the Commonwealth adopts the practices of tendering that is similar to the United Kingdom (UK).

The Royal Institute of Chartered Surveyors (RICS) has issued a new standard of measurement which takes effect on 1 January 2013. One of a suite of documents covering all aspects of measurement and description of a building project, the RICS New Rules of Measurement: Detailed Measurement for Building Works ('NRM 2'), provides fundamental guidance on the quantification and description of building works for the purpose of preparing bill of quantities and quantified schedules of works as well as bespoke schedules of rates. It provides a uniform basis for measuring and describing building works and embodies the essentials of good practice. NRM 2 replaces the Standard Method of Measurement for Building Works ('SMM'), which the latest edition being SMM7, published in 1988 (Royal Institution of Chartered Surveyors, 2012).

The new rules cover all aspects of measurement for the preparation of bill of quantities and schedules of works (quantified). It also addresses all aspects of BQ production, including setting out the information required from the employer and other construction consultants to enable a BQ to be prepared. There are rules of measurement for forty one (41) work sections ranging from preliminaries to building works to transportation.

Other than the NRM2, RICS also produces another standard of measurement for use internationally which is the Principles of Measurement (International) for Works of Construction 1979 (POMI). Royal Institution of Chartered Surveyors (2004) states that these principles of measurement are widely used in international contract and sixteen

(16) of its member countries uses this standard as their measurement guide. This document contains seventeen (17) sections of work items that pertain to building, civil and mechanical and electrical installation works.

Similarly in Singapore which also adopts similar tendering practices, quantity surveyors use the Singapore Standard Method of Measurement for Building Works Second Edition (SSMM2) in measurement of quantities for the preparation of BQ. The SSMM2 consists of 22 sections of rules for different work sections ranging from preliminaries to building works to drainage works (Singapore Institute of Surveyors & Valuers, 1986). The SSMM2 and SMM2 originate from the same document which is The Standard Method of Measurement of Building Works published by RICS in 1960 for use in the Federation of Malaya, Singapore and Borneo.

The Africa Association of Quantity Surveyors has recently produced their first Standard Method of Measuring Building Works for Africa 2015 First Edition (AAQS SMM). This document takes into account the standard methods in use in Africa, being East Africa (Kenya, Tanzania and Uganda), Mauritius, Nigeria, South Africa and Zambia, as well as adopting relevant international tendencies (Africa Association of Quantity Surveyors, 2015). The AAQS SMM is based on the Association of South African Quantity Surveyors' document of Model Bills of Quantities. It has 28 sections covering work sections from preliminaries to building works to external works.

The above standard method of measurement has similar background as the countries are part of the Commonwealth and thus the tendering system is based on the UK system. Nevertheless, each standard method of measurement is produced based on each

country individual requirements of Contracting Departments and the demands of local conditions and practice.

2.12.6 Comparison between Various SMM

The section above provided an overview of the various standard method of measurement used in UK, Singapore, Africa as well as an international standards. The standard method of measurement reviewed above is produced for building works in general with the main emphasis on new build works. This section will compare the various standard method of measurement and review its application for use in building conservation projects. However, as each standard method of measurement is slightly different in their categorisation of works items and the contents, the list of content for each standard method of measurement together with the SMM2 is tabulated in Appendix D for ease of reference and comparison.

A study of the contents of each SMM reveals that all SMMs contain rules and guidelines for work items in preliminaries, demolitions, substructure works, superstructure works, mechanical and electrical works as well as drainage and external works. However, only in NRM2, the word conservation is included in one of the section which is "Alterations, Repairs and Conservation". Other standard method of measurement did not contain any section or clauses for conservation but there is a section or clauses on alteration works. SSMM2 and POMI combined "Alteration" with "Demolitions" in one section while AAQS SMM has a separate section on "Alteration" works.

A review on the contents of the abovementioned "Alteration" sections is needed to identify if the clauses in this section pertains to conservation works. A copy of the said

sections for NRM2, SSMM2, AAQS SMM and POMI is attached as Appendix E for reference. The rules and guidelines for section on "Alteration" in SSMM2, AAQS SMM and POMI did not mentioned the word conservation in any part of the section. However, as the rules and guidelines pertain to repairs and alterations works to existing structures, it is assumed that it can be applied to conservation works where relevant. In addition, there is also no mention of any special works that are specific to conservation.

On the other hand, the section in NRM2 is specifically titled "Alterations, Repairs and Conservation". The rules and guidelines also pertains to repairs and alterations works to existing structures as well as addition sub-section on renovating, conserving, decontamination, temporary works roads and recycling. However, the part on conservation is only a single clause stating that unit of measurement and description on conservation works to brickwork, concrete, stonework, timber and other type to be stated in the BQ. The said clause also requires that the details and nature of the conservation and materials needed be stated in the BQ. If the method of conservation is not to be at the discretion of the contractor, it also has be stated in the BQ. There is also a remark that states, "The unit of measurement shall be left to the discretion of the surveyor but shall reflect the size and extent of the work". Although the NRM2 provides some rules and guidelines for works in conservation but it is very general and does not include any clauses on special conservation works.

As for the section on preliminaries, all SMMs did not include any special item that is conservation specific although there are certain items that are applicable to both conservation and new works such as protection to the work on site. Nevertheless, the requirement for protection to heritage building is more stringent and may even require special covering material due to the fragility of the building parts. As such, although

some of the rules and guidelines in the preliminaries may apply to conservation works, it seems that the rules are not set out to be for conservation works per se. In addition, there is also no rule pertaining to prime cost and provisional sum for conservation work items.

Comparing the other standard method of measurement with SMM2, the consideration of conservation works is not at all evident in SMM2 where there is no surrogate clause in any of the work sections to apply to conservation works. In the Demolition section of SMM2, the clauses only cover works on demolition and shoring. There is no section or clauses for alteration works like in the other standard method of measurement. Thus this is a gap that needs to be filled in order to ensure that the standard method of measurement is comprehensive and is able to cater for the differing works in the local construction industry.

2.13 Relevance of BQ

Bandi and Abdullah (2012) identified eight categories of issues pertaining to the use of BQ in the construction industry which are insufficient information contents, unreliable and inaccurate rates and quantities, poor and unimproved production techniques, unimproved format, limited function, poor and unimproved presentation, failure to recognized builder's knowledge and unable to fulfil the current demand of construction environment. Due to the above issues, the authors opine that the use of BQ may become irrelevant and suggest that a framework for improvement of the BQ be formed.

While there are various studies on BQ and its declining usefulness since the 1980s, the focus is mainly on the BQ lack of usefulness for contractor's use in their planning

and management of construction process. There is hardly any study on the adequacy of BQ for tendering or on the weakness of BQ that causes tender price variance.

Although the prediction of obsolescence for BQ has been around since the 1980s, it still has not happen especially in this country. Despite the heavy workload in producing a BQ, the use of BQ is still widely used in this country (Rashid, Mustapa & Wahid, 2006) because it is still one of the trusted method in obtaining a reliable cost estimate of any proposed project. Quantity surveyors are also willing to go through the time consuming and tedious preparation of BQ because the preparation of BQ is a major source of fees for quantity surveyors (Rashid et al., 2006). Although in UK where it is claimed that the BQ is declining in use, it still accounts for 35% of professional QS workload (RICS, 1984 as cited in Davis and Baccarini, 2004). In comparison, the use of BQ in Australia has declined more than UK where a study by Davis and Baccarini (2004) found that BQ only accounted for no more than 25% of the QS workload. However, in the case of Malaysia, although there is no study on the workload of QS on BQ preparation, it can be assumed that due to the BQ contributing to the bulk of the fees received by professional QS, the workload will also commensurate with the fees.

Although there are other procurement methods that do not require the BQ for tendering such as Design and Build and Turnkey, these procurement methods are not commonly used in this country. The most commonly used procurement method is still the traditional method where BQ plays an important role. Even in country such as Australia where the use of BQ is declining, Davis and Baccarini (2004) cited AIQS recommending the use of BQ for all projects that has complex nature or alterations work. This recommendation is to take advantage of the strength of BQ where it is a document that itemizes in detail the work that is needed in a proposed project. With

detail itemization of all work needed to construct the proposed building, it provides a better method to estimate the cost of the proposed works and thus theoretically it should give an accurate estimate of cost.

2.14 Other Tendering Documents

In the tendering exercise, tenderers are not only given the tender document but also other relevant documents in order for the tenderers to have a full picture of the proposed works. Drawings are one of the important document that accompanies the tender documents. Lee and Lim (2009) identified additional tender requirement that is needed for conservation works which are essential in order to produce an accurate tender amount. The additional requirement includes additional reports such as Historical Architectural Building Survey (HABS) report and dilapidation survey reports, site briefing, site visits, photographic record of the site measurement and observations.

2.15 Summary

This chapter introduces several topics that are pertinent to this research which are cost estimate, tendering and bills of quantities. Cost estimate and tendering are discussed from the viewpoint of variability and factors that causes the variance. Discussion on bills of quantities covers the definition, functions and contents of BQ as well as the form and format of BQ. In addition, this chapter also touches on other types of documents that are included or should be included in a tender. Adequacy of information for tendering is also discussed from two aspects namely the adequacy of format and adequacy of information for BQ. As standard method of measurement is important and guides the preparation of BQ, existing local and international standard method of measurement is also discussed in this chapter including a comparison between the various standard methods of measurement. There are also discussions on

conservation covering its definition in this research, the stages of work and a comparison between new build and conservation works. Upon reviewing the literature, the next chapter will review the research design and methodology adopted. It covers the data collection method, analysis method as well as the validation method that is used.

CHAPTER 3: METHODOLOGY

3.1 Introduction

This chapter discusses the methodology used in this research to achieve the stated objectives. Research methodology is important to ensure that the outcome of the study is valid.

This research is conducted in three stages. The first two stages are fact finding and data collection through desk research, case study of past projects and semi-structured interviews. The desk research comprises literature review of journal papers, books, thesis and other printed and digital references. Other than to identify the research gap, the desk research is used to identify the process and methods of conservation works that is different from new building works as well as providing information on the research methodology to be adopted. The first stage of data collection is to find corroborating evidence through analysis of conservation project tenders to ascertain the extent of pricing differences between tenders in building conservation works. This will achieve the first objective of the research. Following on to the second stage, semi-structured interviews is conducted to obtain further data on the adequacy of current tender documents in terms of the format and sufficiency of information. The findings from this stage will enable the achievement of the second objective of the research.

Data and findings from stage 1 and 2 are used to continue the study in stage 3. The main focus in stage 3 is to achieve the third objective which is to establish a guideline for the preparation of bills of quantities in building conservation works. Upon analysis of the data collected, a proposed guideline for the preparation of conservation work BQ is produced and feedback is obtained from experts in a 2-rounds Delphi survey. The

participants of the Delphi survey are professionals and practitioners in building conservation. The feedback from the Delphi survey is used to improve and refine the proposed BQ guidelines as well as a validation of the usefulness of the proposed guidelines.

3.2 Research Design

The aim of this research as mentioned in Section 1.3 seeks to formulate a guideline for the preparation of bill of quantities for building conservation works which would embody the needs and works that are particular to building conservation. Based on the above premise and considering that the above area has limited research thus far, the approach used in this study is exploratory qualitative.

3.2.1 Research Perspective

In determining the suitable research design, Creswell (2013) explains that knowledge claims, strategies and method all would contribute to a research approach. Knowledge claim is the theoretical perspectives which lie behind the methodology. In this respect it is divided into four schools of thoughts which are post-positivism, constructivism, advocacy/participatory and pragmatism. Research usually does not fall nicely into one category. It is usually a combination of perspectives or it may also be in between the different theoretical perspectives. Nevertheless it is the perspective of the research that leads to the decision of research approach.

In this research, the outcome is to produce a guideline to prepare bill of quantities that is relevant and suited to the needs of building conservation projects. To do so, firstly there is a need to understand the current issues pertaining to the use of such bill of quantities. Understanding is one of the underlying principles of constructivism. In

the constructivism perspective, the research tries to understand the context of the research follow by the interpretation of the findings. As such, according to Creswell (2013), the suitable approach for this perspective is the qualitative approach.

However, constructivism is limited to making sense of the situation in study and interpreting the meaning of the phenomenon. Although this perspective is in line with the first part of this study, it cannot be the sole perspective as the outcome of this research required the solution to a problem. Therefore, there is also a need to design the research that is in accordance with finding a solution. According to Patton (1990), pragmatism concerns with application and solutions to problems. He added that in this perspective, the researcher uses all approaches to derive knowledge about the problems. Creswell (2013) also opines that pragmatism perspective opens the door to multiple methods, different worldviews, and different assumptions, as well as to different forms of data collection and analysis in the mixed methods study.

As such, this research is not entirely based on constructivism or pragmatism perspective because the outcome needed the application of both perspectives. Nevertheless, it leans heavily towards qualitative methods due to the nature of the topic where research is still in its infancy and more exploratory works is required to fully understand the research area. Although the approach is qualitative, some of the data analysis employs methods in quantitative research.

3.2.2 Research Approach

Creswell (2013) explains clearly that if a concept or phenomenon needs to be understood because little research has been done on it, then it merits a qualitative approach. Qualitative research is exploratory and is useful when the researcher does not

know the important variables to examine. Morse (1991) indicates that this type of approach may be needed because the topic is new, the topic has never been addressed with a certain sample or group of people, or existing theories do not apply with the particular sample or group under study. Qualitative approach is adopted in this research because conservation is relatively new in this country and the study of bill of quantities for conservation project has not been addressed thus far. For the purpose of this study, exploratory qualitative design would enable probing into the issues faced in using BQ to price conservation works. Focus is given to the format and content of the BQ and the form that a BQ should manifest for pricing of conservation works.

3.2.3 Research Methods

In order to establish the requisites of a bill of quantities for building conservation works, there is a need to understand the scope and approaches that are involve in this type of work. This allows the research to identify the factors/variables that should be included in a BQ that is reflective of the needs of building conservation works.

In addition to the above, the literature review also helps to formulate the semi-structure questionnaire for the interviews. Interviews are conducted with conservation contractors that have been involved in building conservation projects. The interview survey is to achieve the second objective which is to identify the adequacy of tender documents in building conservation works. Contractors being the party that prices the BQs would be in the right position to provide feedbacks on the adequacy of the BQ in fulfilling its function. The interview surveys enable the research to have a deeper understanding of the process and methods involved in conservation works. In mitigating the problem of the limited availability of literature on the subject matter, the findings from this interview survey would be used to fill in the gaps. Before the actual

survey, a pilot test is conducted to ensure the completeness of the questionnaire and to check the assumptions that have been taken. Semi-structured interviews are used as this method enables probing questions to be asked to elicit responses from the interviewees. The flow of research process can be referred to in Figure 1.1 as shown in Chapter 1.

The research is conducted in three stages. The first stage is to obtain documentary data pertaining to tender information on conservation projects. The second stage is further probing through semi-structured interviews with contractors that have completed conservation projects. The third and final data collection stage is to obtain the feedback on findings derived from the second stage data collection. This feedback is done using Delphi survey method. Each stage of data collection is explained in detail in the following sub-sections. The approach adopted allows the triangulation of data as a check on the validity of the findings. The triangulation is important in this research due to its qualitative approach.

3.2.3.1 Preliminary Document Study

In order to have an understanding of the current scenario in the tendering process for conservation works, the usual method is to have a thorough literature review on the topic. However, in this research, although there is anecdotal evidence that the issue in tendering for conservation project is the high variance in the tender amount, there is no study done on this issue as yet. As such, it is difficult to find much literature discussing this topic. Having said that, the study conducted by Lee (2009) found that there are weaknesses in the bill of quantities used in conservation projects. However, the said study did not provide any indication of the tender price variance. This means that although there are weaknesses in the bill of quantities used in conservation projects, the issue at hand, which is high tender variance, is still not clear yet.

As such, before this research can proceed further, there is a need to identify if this phenomenon does exist. Considering that there is a lack of published data on tender amounts for conservation projects, a preliminary study on existing tender records is conducted to examine this occurrence of high variance in conservation tenders. Comparative analysis was used to corroborate anecdotal evidence that the variance level of tenders in building conservation projects is high. The flow chart is shown in Figure 3.1.

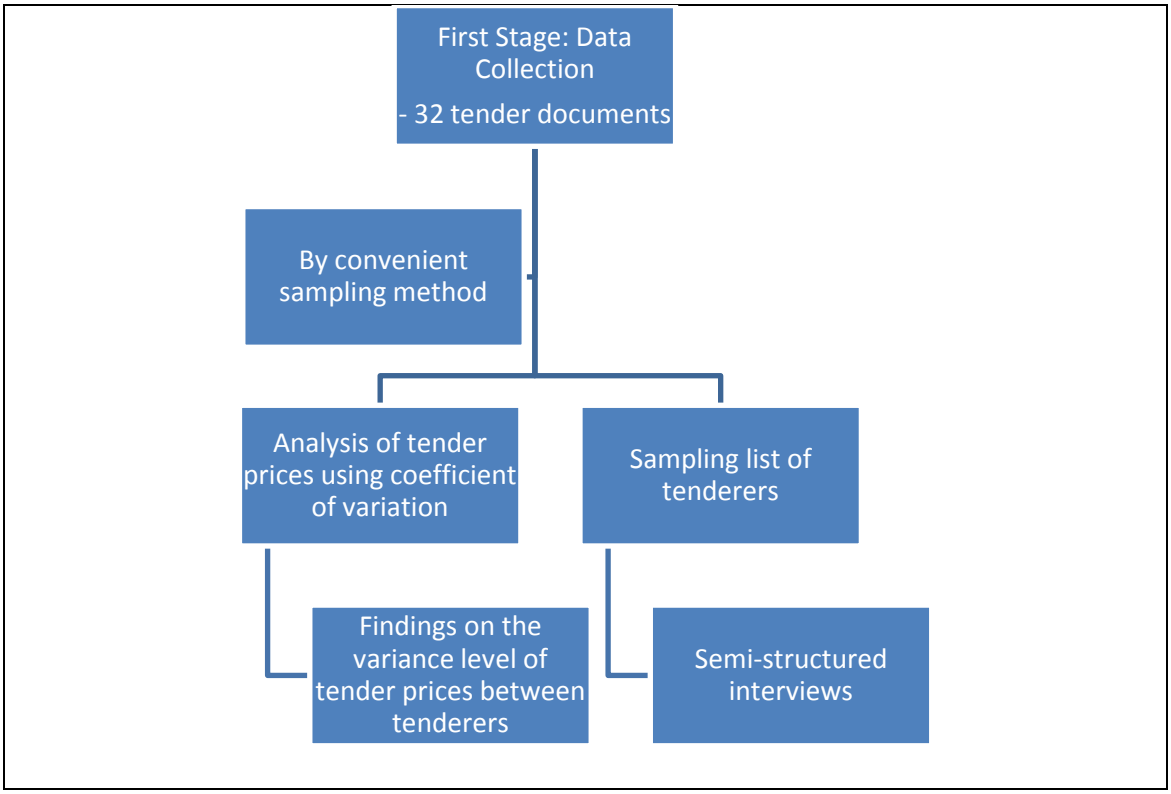

Figure 3.1: Flow chart for preliminary document study

In practice, conservation projects consist of various sizes. Some are small works focussing on repairing damaged elements of the building while others are extensive restoration of heritage buildings. In general, private projects that are mainly small works have simple quotation from the contractors due to the small volume of work needed. While large private conservation projects although uses bill of quantities for tendering, the bill of quantities vary according to the requirement of the client and thus

it is inconsistent from one job to another which makes it difficult to analyse due to the many possible permutations. On the other hand, conservation projects by the government are tendered with complete documentation following standard government tendering procedures.

Since the scope of the research focus on a standard and complete bill of quantities, the relevant cases for the preliminary study would naturally fall on conservation projects procured under government contract. This would ensure that the data can be compared on an apple to apple basis. Limiting the scope to only government contract ensures that the tendering method and tendering procedures that is used in each project follows the same standard method and procedures. This is done on purpose to ensure that the tendering conditions are the same so that the study could discover other variables that may cause high variance in the conservation works tenders. Tendering methods and procedures for government contract is the same for the same type of procurement methods regardless of the type of projects. Therefore, if the project is tendered based on bill of quantities, the tendering method and procedures is the same for new build or conservation works. By choosing government contract for this study the tendering method and procedures variables can be kept constant.

The Department of National Heritage, local authority of George Town and Melaka was approached to obtain the necessary data. The local authorities of George Town and Melaka was chosen as both cities was inscribed as World Heritage City by UNESCO and are known to have conserve selected buildings which the works was procured through government tender. During the data collection stage, it was found that some projects was tendered out by the Public Works Department(PWD) and PWD was also included in the list of source of tender information. The main obstacle faced during data

collection pertains to the confidentiality of the data and the destruction of data. Data on newly tendered projects are not released due to confidentiality of the data despite the assurance that project name will not be recorded or revealed. On the other hand, data on old tender projects are no longer available as the tender documents have been destroyed or lost while moving offices. Despite the difficulty and constraints, data was collected from thirty two (32) tenderers from four conservation projects. One project was completed in the year 2010 while the other three projects were completed in 2012. The projects consist of conservation works to a government administration building for the Anti-Corruption Agency, residential buildings for leprosy hospital, a fort and a city hall building. These four projects are used in this study because it complied with the focus of this study. Detailed data broken down by BQ sections was also collected for each building for further analysis.

For the purpose of comparing with conservation works data, this study also endeavour to obtain the Coefficient of Variation (CV) of tenders for new build works. However, currently there is no published data on CV of new build tenders. Assuming that the variability of new build tenders is quite similar for all types of new build works, a small random sample of new build tender data is obtained from a private quantity surveying consultant firm for the purpose of comparison only. The research acknowledged that the number of projects obtained is low but the findings are not intended to be part of the research outcome. These data are only to serve the purpose of this preliminary study which is to determine if anecdotal evidence of high tender variance is hearsay or otherwise. It is reiterated here that the reason for this preliminary study is because of the insufficient literature that is needed to affirm the issue of high tender variance.

3.2.3.2 Semi-structured Interview

This stage of data collection focuses on the problems that contractors faced when they are pricing the tender for conservation projects, the reasons for the problems as well as the comments on the bill of quantities currently in use. In order to understand the factors that cause difficulty to the contractors when they price including the adequacy of the tender documents, data collection methods that allow for in-depth exploration is considered. The common methods used for such data collection are group discussion such as focus group or workshop and in-depth interview.

Although group discussion method is useful for exploratory research as it allow in-depth exploration of an issue which is suitable for this research but it also has it disadvantages (Stewart, Shamdasani, & Rook, 2007). Both focus group and workshop required all participants to travel to a certain location to participate at a given time and the discussion moderated by a trained facilitator. Workshop usually has more participants than focus group and thus may require more facilitators. The operation of the group discussion forms the constraint in this research as the respondents are from different locality namely, Penang, Kuala Lumpur and Melaka which would entails long distance travelling by at least two thirds of the respondents, i.e. from Penang and Melaka to Kuala Lumpur. This may deter the selected respondents to participate due to time and cost factor. Another disadvantage is that the results may be biased by a very dominant member and reserved member may be hesitant to talk (Stewart et al., 2007). This is a major concern in an Asian setting like in this research. Taking into consideration the constraint of long distance travelling by respondents and the bias that may occur due to dominant member, this research selected the in-depth semi-structured interview method.

The in-depth semi-structured interview method also allows for probing of responses (Morris, 2015) to explore an issue. The advantage of this method is that it allows the researcher through the interviewee, to access a range of insights and thoughts about a particular topic and to collect rich data fairly quickly (Morris, 2015). This method is adopted because in addition to identifying the factors influencing tender variability, this study also wanted to understand how these factors influence tender variability. The qualitative research interview is the most widely used qualitative research method (Polkinghorne as cited in Schultze & Avital, 2011) and has been used extensively in multiple disciplines (The flow chart is shown in Figure 3.2). Due to scarce literature on bill of quantities for conservation projects, in-depth semi-structured interviews are a suitable method to probe for information for a deeper understanding of the issues at hand. According to Barriball & While (1994) probing can be an invaluable tool for ensuring reliability of the data. This is because probing allows for the clarification of interesting and relevant issues raised by the respondents (Hutchinson & Skodal-Wilson, 1992) as well as enable valuable and complete information be obtained during the interviews (Gordon, 1975; Austin, 1981; Bailey, 1987).

There are also other advantages in using this method such as it gives a better response rate than questionnaire survey (Austin, 1981; Bailey 1987) as well as facilitate comparability by ensuring that all questions are answered by each respondent (Bailey, 1987). In addition, face to face interview may motivate respondents to participate (Gordon, 1975). Rowley (2012) also advocates interview surveys when the research objectives centre on understanding experiences, opinions, attitudes, values, and processes and there is insufficient information known about the subject to be able to draft a questionnaire.

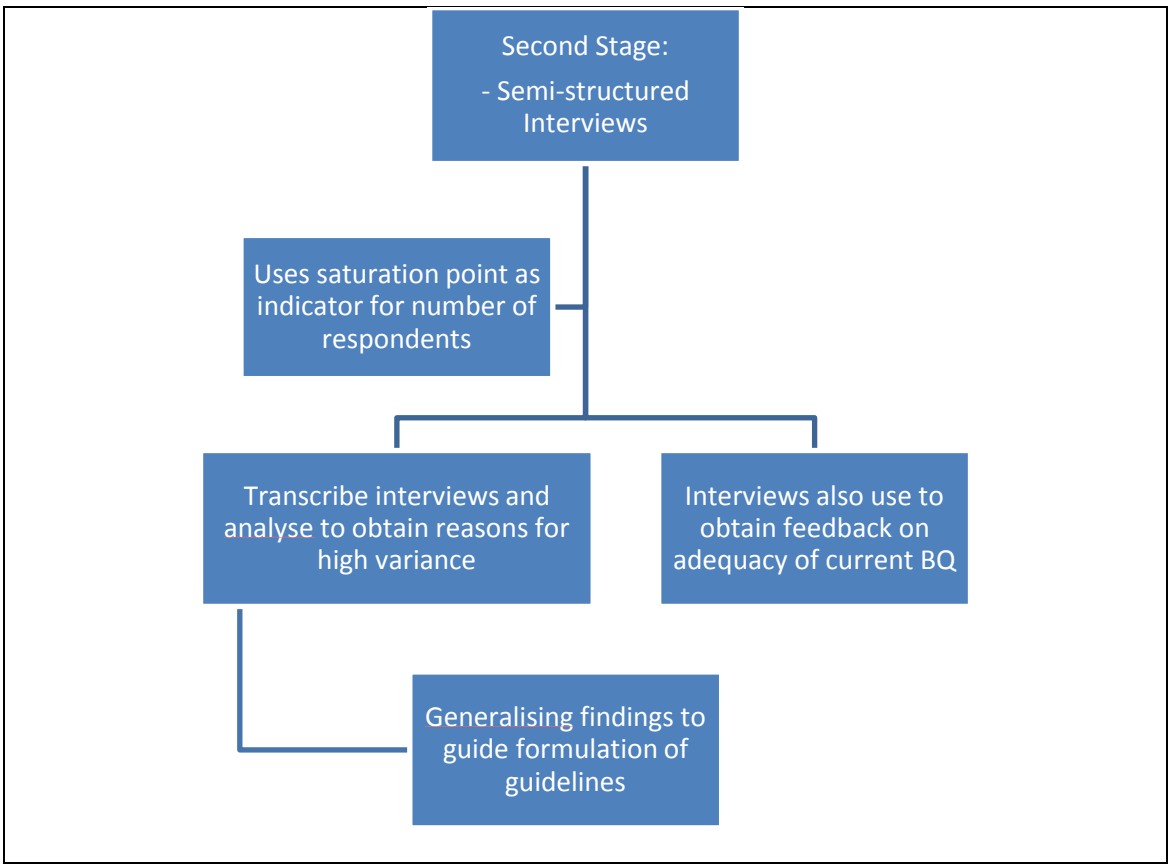

Figure 3.2: Flow chart of semi-structured interviews

As the scope of the research is on the format and content of bill of quantities, the semi-structured questionnaire is designed based on quantity surveying texts on the process of preparation of bill of quantities. Upon the completion of the questionnaire, a pilot study was conducted to test the suitability of the semi-structure questionnaire for the purpose of this study. The pilot phase allowed for informed changes and adjustments to the interview questionnaire before main data collection (Barriball & While, 1994). The pilot study was given to three respondents, two are quantity surveyors and another is a researcher in heritage. Two quantity surveyors are chosen for the pilot study because quantity surveying principles and processes underpins this research and their feedback is important to ensure that the quantity surveying principles are in order. While the third respondent provides feedback on the design of the questionnaire such as wording, order of questions as well as the conservation process terminologies used in the questionnaire. The questionnaire is designed for an interview

of about an hour. Upon feedback from the pilot study, the initial questionnaire is improved and readied for the execution of the interviews. A copy of the questionnaire is attached in Appendix A.

The study targeted only contractors that have prior experience in tendering for conservation projects. The reason being conservation project has different needs and requirement from new build projects. Ahuja and Campbell (1988) found that conservation works has non-standard scope of works and require a different construction approach. Therefore in this research, only contractors that have prior experience in conservation project would be able to provide feedback that reflect the issues faced by contractors during tendering in the conservation industry.

A sampling frame was compiled from the list of tenderers for conservation projects obtained from all the authorities that was visited in the preliminary study namely the Department of National Heritage, Public Works Department and the local authorities of George Town and Melaka. The list is compiled from the above agencies to ensure that only contractors that have done conservation works is selected. The study conducted by Lee (2009) used a list from CIDB but found that most of the contractors do not have conservation work experience but have only completed renovation and refurbishment projects. Therefore, this source is not used to avoid the same problem. Telephone call was made to each tenderer in the sampling frame to seek for their agreement to participate in the survey as well as to verify if they have been involved in conservation works. After the calls, the sampling frame is then further refined by the following criteria.

1. Firms no longer operating are removed.
2. Firms that cannot be contacted are removed.

3. If several firms belong to one owner, only the most active firm is included in the sampling frame.
4. Firms that refuse to participate in the survey are removed.
5. Firms that do not have experience in the conservation projects are removed.

Upon the above refinement, the initial sampling frame of twenty six (26) contractors is reduced to twelve (12) contractors. From the final list, only ten (10) contractors were successfully interviewed as the remainder two contractor could not participate; one due to being overseas and the other is only involved in the waterproofing treatment and not as a main contractor. Nevertheless, the total interviews conducted complied with the 'general rule of thumb' for an interview survey sample that is within the acceptable range of between 5 – 25 interviews as recommended by Kvale (1996) and Kvale and Brinkmann (2009). All respondents fulfil the criteria of having prior experience in conservation works and are willing to participate in the survey.

The face to face interview sessions are carried out from the month of March 2014 until April 2014. The respondents are located in Penang, Kuala Lumpur and Melaka and the duration of each interview average about one hour with the shortest being 40 minutes and the longest, 1 hour and 9 minutes. The location of the interview is a place of convenience to the respondent, some at the respondent's office while some is at the respondent's conservation project site. With permission, each interview is recorded to be transcribed later. The use of recording ensures that an identical replication of the contents of each interview is available and this will facilitate analysis as well as validate the accuracy and completeness of the information collected (Barriball & While, 1994). The same authors also advocate taping as it reduces the potential for interviewer error in recording data incorrectly or cheating. Upon completion of the interview session, each

piece of interview is transcribed and typed out for analysis. The analysis method is discussed in Section 4.40. Parts of the findings are also used to design the questionnaire in the next stage of data collection.

3.2.3.3 Delphi Method

Findings from the semi-structured interviews stage need to be corroborated by the experts in the research area in order to answer research question 5. In order to decide on Delphi survey method as a suitable method, several considerations need to be examined. The first consideration pertains to the condition that group consensus is needed to decide on the suitable BQ format and content for conservation works. In order to obtain this group consensus, two methods come to mind. One is focus group and another is the Delphi method.

Focus group method obtains group consensus by bringing all experts together and capitalizes on communication between research participants in order to generate data (Kitzinger, 1995). It is a form of group interview and is useful for exploring people's knowledge and experiences and is used to examine what and how people think as well as why they think that way.

The origin of the Delphi method was created to obtain the most reliable opinion consensus of a group of experts (Dalkey & Helmer, 1963). The Delphi Method is also known as a method to draw out conclusions based on consensus by a panel of experts (Bourgeois, Pugmire, Stevenson, Swanson, & Swanson, 2006; Landeta, Barrutia & Lertxundi, 2011). Landeta et al. (2011) also explains that this method seeks to obtain a reliable group opinion. This method is conducted by forming a panel of experts and

doing an iteration of the questionnaires and evaluation of previous iteration and finally drawing the conclusions from the consensus of the panels.

Comparing both method, the focus group method is not used due to the following reasons. Edmunds (1991) explains that focus group method is not suitable for making final decisions, obtaining quantitative assessments or opinions and defining prices or cost preferences. Such limitation makes it not suitable for this research as the consensus is needed to confirm the format and content of bill of quantities for conservation works. On the other hand, Delphi method is suitable for obtaining consensus when there are unknowns and uncertainty (Bourgeois et al., 2006). Due to the relatively new area in conservation, Delphi method is deemed to fit the purpose and is used in this research in the final rounds of data collection. Another benefit of Delphi method is that it allows groups of experts to be located at different locations, increasing participation and the range of perspectives taken into consideration (Geist, 2010). The advantage of Delphi method over focus group is that the Delphi method avoids direct confrontation of the experts with one another (Dalkey & Helmer, 1963). The flow chart for Delphi survey is shown in Figure 3.3.

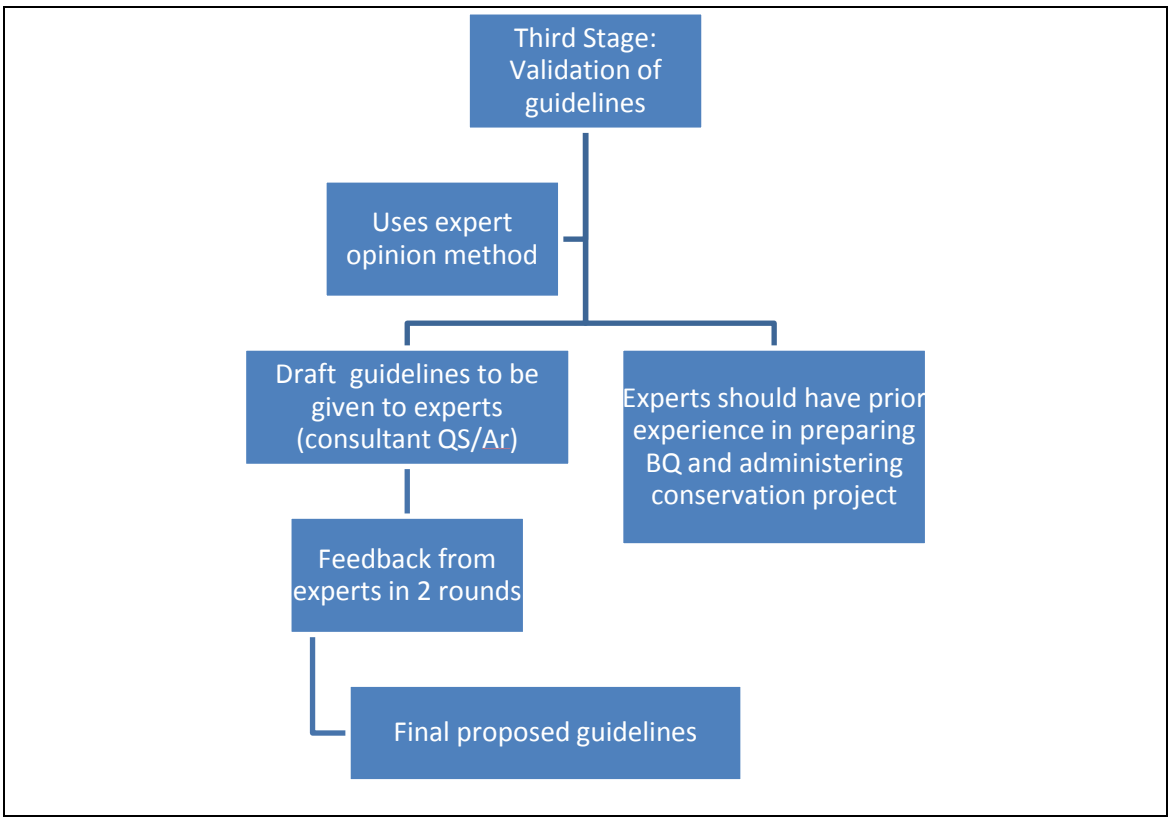

Figure 3.3: Flow chart of delphi survey

The main characteristic of Delphi method is the numerous iteration of questionnaire but there is no consensus on the number of rounds required. Some study use two rounds while there are studies that use up to five rounds. Classic Delphi method uses four rounds but later researches has employed either two or three rounds (Sumsion, 1998). Concerned with fatigue by respondents (Walker & Selfe, 1996), this research adopts the two rounds Delphi method. It is also hoped that with two rounds the attrition rate will be low. On hindsight, the number of rounds that is more than two is not suitable as it was difficult to obtain replies in the second round where reminder has to be sent numerous time to ensure there is no attrition.

Since the Delphi technique focuses on eliciting expert opinions over a short period of time, the selection of Delphi subjects is generally dependent upon the disciplinary areas of expertise required by the specific issue (Hsu & Sandford, 2007). They further

highlighted that no exact criterion currently listed in the literature concerning the selection of Delphi participants. However, they added that individuals are considered eligible to be invited to participate in a Delphi study if they have somewhat related backgrounds and experiences concerning the target issue, are capable of contributing helpful inputs, and are willing to revise their initial or previous judgments for the purpose of reaching or attaining consensus. In addition, there is no consensus on what constitutes an optimal number of subjects in a Delphi study.

Studies by others as cited by Mullen (2003) use various size of panel as follows.

1. 8-12 experts (Cavalli-Sforza & Ortolano, 1984)
2. 7-12 experts (Phillips, 2000)
3. 10-50 experts (Turoff, 1970))
4. 300-500 experts (Wild & Torgersen, 2000)
5. 4 -3000 as reported by Cantrill, Sibbald, and Buetow (1996).

Linstone (as cited in Mullen, 2003) finds that "a suitable minimum panel size is seven" with accuracy deteriorating rapidly with smaller sizes and improving more slowly with large numbers. The Delphi study should not be confused with conventional quantitative studies where large numbers are needed to ensure representativeness of a population is obtained from the sample. The number of expert chosen for this research is ten which follows the optimum recommendation by Phillips (2000) as between eight to twelve numbers. Linstone (as cited in Mullen, 2003) explains that an expert in a Delphi study is defined as someone who is knowledgeable in the area of the research. This expert should also be someone that can provide relevant input to the Delphi survey (Pill, 1971). There are no fixed criteria on the selection of experts and it is usually determined by the researcher (Bourgeois et al., 2006)

Unlike traditional statistical surveying, the goal is not to select a representative sample of the population. The whole premise behind the Delphi theory is that the panel members are in fact experts in their field in order to yield more accurate results (Bourgeois et al., 2006). In this research, the expert is defined as someone who has knowledge in the use and pricing of bill of quantities as well experience in conservation projects. The quantity surveyor and architect that have experience in conservation projects would fulfil both criteria. As such to ensure the formation of the panel, quantity surveyors and architects that are known to have conservation project experience are contacted to seek their consent in participating in this Delphi survey.

Although contractors in conservation projects are well versed with bill of quantities, they are not included in the panel because this stage of data collection is to seek confirmation and verification from other experts on the findings obtained from the contractors. In addition, the population of these experts are unknown as there is no proper record or compulsory registration of quantity surveyors or architects that participate in conservation works. Both professions are registered with their respective board but there is no special register for those that are involved in conservation projects. A sampling frame and sample size is not relevant here as pointed out by Beretta (1996) where representative sampling techniques may be inappropriate when expert opinions are required. Goodman (1987) notes that the originators of Delphi do not really advocate a random sample of panellists, instead advocate the use of experts or at least informed advocates, especially in forecasting.

A list of experts is drawn up by identifying all known quantity surveyors and architects that are involved in conservation projects. The names are obtained from the authorities where data collection are conducted as well as recommended by the

contractors in the semi-structured interviews. This is to ensure that the experts have prior experience in administrating public conservation projects. In order to ensure that the experts from various affiliation are represented, the list includes experts from both the private and public sector including a quantity surveyor from the National Heritage Department as this department also tender out building conservation projects. The lone academician in the list is chosen as he is actively involved in many public projects as a conservator consultant. The list of experts and their profession as well as their affiliation is given in Table 3.1 below.

Table 3.1: List of experts

No	Profession	Affiliation	Years of experience in conservation
1	Quantity Surveyor	Private Consultant Firm	15 years
2	Quantity Surveyor	Private Consultant Firm	13 years
3	Quantity Surveyor	Private Consultant Firm	7 years
4	Quantity Surveyor	Private Consultant Firm	3 years
5	Quantity Surveyor	Public Works Department	4 years
6	Quantity Surveyor	National Heritage Department	1 year
7	Quantity Surveyor	Local Authority	3 years
8	Conservation Architect	Private Consultant Firm	20 years
9	Conservation Architect	Private Consultant Firm	20 years
10	Conservation Architect	Private Consultant Firm	16 years
11	Conservation Architect	Academician	20 years
12	Architect	Public Works Department	1.5 years

The implementation of the Delphi method survey is from September 2014 to January 2015. The first questionnaire is sent by email and by hand to the panel of experts in September 2014 and was returned in October 2014 after numerous reminders. A copy of the questionnaires are attach in Appendix B. The replies are compiled and percentage of agreement for each question tabulated. The second questionnaire included the remarks from the first round as well as some new questions. The second questionnaire was emailed in December 2014 and while many replied within the stipulated time of two weeks, a few experts took a longer time and only in January

2015, all replies are received. In the second round, the questionnaire consists of two parts. The first part consists of the questionnaire proper and the second part consists of items that have reached consensus. The second part of the questionnaire is to provide feedback information from the first round to the panellists. Only questions that have not received consensus are being asked again in the second round. The 2-rounds Delphi survey is as other research shows that dwindling response increases with additional rounds.

As with all methods, the Delphi method is not infallible. Strauss and Zeigler (1975) have criticized the claim that the Delphi technique represents valid expert opinion as scientifically untenable and overstated. Limitation also includes are that validity may be compromised due to panel members changing highly relevant views in the face of a different view from the main body of the panel. The extent to which participants agree with each other (consensus) does not mean that the 'correct' answer has been found (Keeney, Hasson, & McKenna, 2006). However, this limitation does not pose a major problem in this research as the Delphi method is used to obtain consensus on issues that derived from the earlier stage of data collection. There is no right or wrong answer to be determined but only the most suitable answer for the specific topic at hand. Many challenges and questions are raised when using the Delphi technique, but there is no doubt that it is an important method for achieving consensus on issues where none previously existed. If researchers merely want to gauge the knowledge or opinions of a group of people, there are many research approaches from which to choose. However, if they wish to establish consensus or obtain a judgement on an issue, a Delphi survey may be the appropriate method (Keeney et al., 2006).

3.3 Questionnaire Design

This research employs two sets of questionnaires, one for the semi-structured interviews and another set for the Delphi survey.

3.3.1 Questionnaire for Semi-structured Interviews

A questionnaire is prepared for the semi-structured interviews to act as a guide during the interview sessions. This is important when there may be language barriers during the interview. With the questionnaire as a guide in combination with the flexibility of the semi-structured interview method, this will ensure that valid and reliable data is obtained (Barriball & While, 1994).

The questionnaire is divided into three parts where the first part are questions pertaining to the interviewee's background. Generally, the questions are informed by both practice and theory (Rowley, 2012) where the next two parts are based on the technical aspects and standard format of bill of quantities. In addition, there are also questions asking for the opinion of interviewees on tendering and BQ for conservation works that they have experience in. The second part of the questionnaire is to achieve the research objective no. 2 which is to identify the adequacy of tender documents currently used in building conservation tendering in terms of format and sufficiency of information to enable accurate cost estimating. While the third part is to obtain information to formulate the proposed framework for a BQ specific to conservation works. Feedback and suggestions from this part is incorporated into the proposed framework.

Questions are created to facilitate the exploration into each theme that this research intends to develop with a focus on questions that are as open as possible (Broom, 2005).

The questions are designed to create an open environment in which the interviewee can reflect on issues that is being introduced within the context of their own experience (Ezzy, 2002).

3.3.2 Questionnaire for Delphi Survey

The first round questionnaire for the Delphi method was divided into sections based on structure found in a bill of quantities as well as items identified from the semi-structured interviews. The sections comprise of preliminaries bill, measured works bill, prime cost and provisional cost sum, schedule of rates, method statement, dilapidation report, historical and architectural building survey and research report. Each section is in a table format and the experts are asked to select agree or disagree with the given statement and a column is provided for the experts to note down their comments. This format is used to allow the experts to go through the questions with ease and systematically.

The second round questionnaire is similar to the first round so that the experts are familiar and do not need to waste time familiarising again. However, questions that have reached consensus which is above 67% of agreement or disagreement are removed. These questions together with the consensus percentages are compiled together in an attachment to the second round questionnaire and given to the experts for the reference. The remainder questions that have not reached consensus together with a number of new questions form the second round questionnaire. The new question arises from the comments of panellist in round one. The consensus percentages and all remarks from the first round are also included in the second round questionnaire. This is done in accordance to the premise of Delphi method which is to allow the experts to reconsider their answers based on the replies of others in the earlier round.

3.4 Data Transformation

Data collected are being analysed using a mix of statistical and qualitative analysis techniques. The two main descriptive statistics used are coefficient of variation and measure of central tendency while thematic analysis is used in analysing the interviews.

3.4.1 Descriptive Statistics

Data analysis was carried out using coefficient of variation (CV) in the preliminary study to identify the extent of variability among the different tenderers. The coefficient of variation is mathematically expressed as follows.

$$C_v = \frac{\sigma}{\mu}$$

Where CV is the ratio of the standard deviation σ to the mean μ. This statistical method was used as it shows the extent of variability in relation to mean of the population. It is suitable for this study as the data collected are measured on a ratio scale and there is no negative value. . The CV is used as the measure of dispersion here because the mean for each project vary greatly especially when the comparison is between different type of construction works namely between restoration, refurbishment and new build. When comparing such differing data set, using the mean or standard deviation does not provide a meaningful comparison on the degree of dispersion among the data set. Therefore, CV which does not have unit would provide a more meaningful comparison among the variables where a smaller CV value means that is it less dispersed than a CV with a larger value (UCLA, 2015). The use of the CV is to indicate the dispersion of the tender amounts; the higher the CV, the higher the dispersion of the tender amounts meaning that the tender amounts has greater variance. In other words, the higher the CV number, the bigger the difference between the tender

amounts. However, by just looking at the CV of conservation projects it is difficult to say if the variability found is a normal occurrence for construction works or is it higher than the norm. As such, the CV for new build projects is also calculated to be compared with the CV of conservation projects.

In order to achieve this, tender data was also collected for new build works. The intention of calculating the CV of new build works is only to obtain a general indicator of the CV for new build works. The study is not concern with of building type and size as the measurement of CV is without unit and thus enable different variable to be compared on the same scale. Therefore, data was randomly collected for various types of new building. The data collected for new build works includes terrace houses, apartments, bungalow, hospital and shop houses.

The measure of central tendency is used in the analysis of the data from the Delphi method. The mode is used to determine the consensus in the replies. Where a clear consensus is not forthcoming in both rounds, the mean of both rounds is calculated to determine which answer returns the highest vote.

In presenting the conclusions from Delphi method, consensus is being mentioned all the time. At what percentage agreement or disagreement is considered as consensus? Hasson, Keeney, and McKenna (2000) states that there is no universally agreed proportion for the Delphi because the level used depends upon sample numbers, aim of the research and resources. Keeney et al. (2006) also recognises that there is no accepted guideline for an acceptable level of consensus or any scientific rationale in any of the consensus level chosen in previous researches. Previous researches have used consensus level from 51% (Loughlin & Moore, 1979), 75% (Keeney et al., 2006) and

up to 80% (Green, Jones, Hughes, & Williams, 1999). Nevertheless, Keeney et al. (2006) opine that establishing the standard is crucial as the level chosen determines what items are discarded or retained as the rounds unfold.

As there is no standard on consensus level, the acceptable level is depended on the research topic. A topic with "life or death" issues (Keeney et al., 2006) will need a 100% level while a lower level will suffice for a topic without such critical issue. As the level of consensus is based on a case by case basis, this research uses the following criteria to determine the level of consensus.

1. The topic of research does not have a life and death scenario thus a 100% consensus is not required.
2. The experts would have differences in their opinion due to the complexity and uniqueness of conservation works, therefore expecting a 100% is not realistic.

Based on the criteria listed above, the consensus level adopted is two thirds or 67% percentage. The reason for adopting 67% is because it is a concern of this research that a high level of consensus may create a situation where consensus cannot be reached due to the complexities of conservation works and the different experiences of each experts in conservation works. The two thirds or 67% is based on the concept of majority in decision making where two thirds which is more than half of the total forms the greater part. Thus there is safety in numbers where it is less likely for more than half of the people to arrive at a wrong decision than a single individual or lesser majority (Hasson et al., 2000). The same consensus level is used for both rounds.

3.4.2 Thematic Analysis

The interviews responses were transcribed and thematic analysis performed on the transcribed data. The thematic analysis conducted is adapted from the steps proposed by Braun and Clarke (2006). Referring to Table I, the familiarizing phase is done during the transcribing process where all the interviews are transcribed by the author. For the second phase, the transcribed data is printed with a wide right margin to enable the author to write down the coding of interesting and relevant points derived from the transcript. During the third phase, similar codes are brought together to create emerging themes which is the step towards conceptualizing the data. The themes are now given a label and review in the fourth stage to further refine and define the themes. The themes identified are driven by the objective of the study which is to find the causes of high variability in conservation tender. This forms the findings of this study. It is new knowledge pertaining to tendering in building conservation from the perspective of the respondents.

3.5 Validity and Reliability in Qualitative Approach

In research it is important that the study is found to be credible and credibility of a research amounts to validity and reliability. Both concept of validity and reliability is central to the discussion of the credibility of scientific research (Silverman, 2006). The measures of validity and reliability of a research must be determined from the definition of the research approach, i.e. quantitative or qualitative. The reason as espoused by Bapir (2012) is due to the different ontological and epistemological of both approaches standpoint in relation to the social world. Therefore, this research attempts to ensure the credibility of the research by employing the methods used in qualitative approach to ensure validity and reliability of the findings.

3.5.1 Validity of the Research

The concept of validity in qualitative research pertains to truthfulness (Lawrence, 2003) where the account of the phenomena is presented accurately in the research. The concept of validity in qualitative research concerns on how the research is conducted. Has the research been conducted in a systematic and transparent manner? Mays & Pope (1995) explains that validity is achieved when accounts from different stakeholders are explored to identify patterns of convergence. This concept is often utilized in qualitative research using interviews. Qualitative research is seen to be more valid than quantitative research because in qualitative research it is the observed or people that speak instead of statistical data.

Having defined validity in qualitative research, it is important to know the validation strategies that are utilized. Verification strategies that ensure both reliability and validity of data are activities such as ensuring methodological coherence, sampling sufficiency, developing a dynamic relationship between sampling, data collection and analysis, thinking theoretically, and theory development (Morse, Barrett, Mayan, Olson & Spiers, 2002).

Methodological coherence is achieved in this research through having three phases of data collection, each phase answering a question and establishing the next research component and yet at the same time verifying the previous component. Taking it in all together will constitute verifying the methodological assumptions as a whole. In this approach, triangulation is not only on the data but also on the findings where each phase checks and validates the findings of the previous phase.

Sampling sufficiency is achieved in this research through data saturation. According to Morse (1991), sampling adequacy is evidenced by saturation and replication. Saturation means that sufficient data to account for all aspects of the phenomenon have been obtained. By definition, saturating data ensures replication in categories; replication verifies, and ensures comprehension and completeness. Appropriateness of the sample in this research is achieved by selecting respondents that are knowledgeable in this topic, i.e. contractors, architects and quantity surveyors that have prior experience in handling building conservation projects.

Morse, et al. (2002) also advocate collecting and analysing data concurrently as the essence of attaining reliability and validity. This is evidenced in this research where the data collected and analysis conducted determine the next phase of the research. Methods used in Phase 2 are influenced by the data and analysis of Phase 1 while the questions in Phase 3 are influenced by the data and analysis of Phase 2. In Phase 3, the method employed which is the Delphi survey method, utilises this iterative interaction to obtained validation of the findings. This type of strategy is sometimes employed in qualitative research where findings are being fed back to the participants to see if they regard the findings as a reasonable account based on their experience (Mays & Pope, 1995). In a way, the reactions from the participants to the evolving analysis will become part of the emerging research data.

The fourth verification strategy espoused by Morse et al. (2002) pertains to the checking and rechecking of the ideas emerging from data. This is done by confirming the new ideas that emerged with new data and at the same time this also means that the new ideas from the new data are verified by previously collected data. This process is apparent in this research where the framework emerged from the interviews are being

confirmed by data collected in the Delphi survey. Where the Delphi survey is in agreement with the ideas emerging from the interviews, this means the ideas are confirmed by the new data. At the same time ideas that did not reach consensus in the Delphi survey are being feed back into the panellists as a check to determine if it should be discarded. In this way, iteratively the foundation is being built. This in practice will lead to the development of theory and together, all these strategies will contribute to and build reliability and validity, thus ensuring rigor (Morse et al., 2002).

3.6 Summary

This chapter discusses the methodology used in this research explaining the research design, data collection and data analysis methods. The data is collected through several methods which are document study, semi-structured interviews and Delphi survey method. Data are analysed using descriptive statistics employing the calculation of coefficient of variation for the tender variance part and the measures of central tendency for the Delphi survey while the semi-structured interviews are analysed using thematic analysis. The use of different methods provides a check on the validity of the research through triangulation techniques. The next chapter presents the data, analysis and the findings of this research. The discussion begins from the data collected from document study to the thematic analysis of the semi-structured interviews and finally the development of the draft guidelines.

CHAPTER 4: DATA COLLECTION AND ANALYSIS

4.1 Introduction

This chapter presents the data collected in three parts, each part attempting to answer one part of the objectives of this research. The data collected in the first part attempts to answer the first objective which is to ascertain the extent of pricing differences between tenders in building conservation works. Data is collected to corroborate with anecdotal evidence of high variance in the tender amount of conservation project to ascertain if such occurrences are true for building conservation projects. This is secondary data collected from tender records of past projects.

The second part of data collection is to answer the second objective which is to identify the adequacy of tender documents currently used in building conservation tendering in terms of format and sufficiency of information to enable accurate cost estimating. For this purpose, primary data is collected through semi-structured in-depth interview with contractors that have experience in restoring heritage buildings.

The third and final part of data collection is to determine a suitable format and structure of information for bills of quantities that can adequately described the works involved in building conservation to enable accurate cost estimating during tendering stage. Delphi survey method is used to collect the required data to answer this third objective.

4.2 Tender Comparison

Tender comparison is a common method that is used in the industry to compare the various tenders received for a project. The amount from each tenderer will be placed

side by side and the usual practice is for the client to choose the tenderer with the lowest amount. However, in this research, additional analysis will be conducted on the data to obtain the variance level between the tender amounts. The discussion on the analysis is presented in the following sections.

4.2.1 Overall Tender Comparison

In order to ascertain the pricing variance among tenderers, a study on the actual tender records for conservation works is conducted. A total of thirty two (32) tenders were collected from four conservation projects. All four projects are public contracts, one each by the local authority in Penang and the Public Works Department and the other two by Jabatan Warisan Negara. One project was completed in the year 2010 and the other three projects were completed in 2012. The projects consist of conservation works to a government administration building for the Anti-Corruption Agency, residential buildings for leprosy hospital, a fort and a city hall.

The project for Building 1 (B1) is restoration to the Penang Anti-Corruption Agency building. This is a two-storey building built by the British in 1920. The works took 18 months to complete. The original state of the building remained with repairs done to the damaged parts. The restoration works for Building 1 is procured using traditional method with Bills of Quantities.

The project for Building 2 (B2) consists of restoration to several residential units located on the premise of the former Leprosy Settlement in Sungai Buloh. The leprosy settlement was built by the British in 1930 and was planned as a garden city divided according to the function i.e. administrative area comprising of a hospital and public amenities and residential area (Jabatan Warisan Negara, 2017). The tenders are for the

Phase 1 restoration works to the residential buildings. The restoration works is procured using Design and Build method. However, a BQ without quantities was produced for the tender exercise.

Building 3 (B3) is a fort located in Sarawak which was built in 1879 by Charles Brooke. The fort consists of a three storey tower block with a courtyard surrounded by high walls punctuated with windows for cannons. The design in square on plan and the fort is constructed of clay bricks with lime mortar plaster (Jabatan Warisan Negara, 2017). The restoration works to the fort is procured using traditional method with Bill of Quantities.

The fourth building, i.e. Building 4 (B4) is a City Hall which was built in 1903. It is a two storey masonry building with an Edwardian Baroque architectural style. Although it is a masonry building, many of the building elements are constructed from timber namely ceilings, floors and opening frame. The procurement method for this building is also traditional procurement with Bill of Quantities.

These four projects are chosen because the required tender information and document is available and accessible. Table 4.1 below shows the comparison of tender amount for each project.

Table 4.1: Comparison of tenders for each project

No	Tender 1	Tender 2	Tender 3	Tender 4	Tender 5	Tender 6	Tender 7	Tender 8	Tender 9	Tender 10
B1	1,249,957	1,952,889	1,650,100	1,612,405	1,195,380	1,793,150	1,700,000	1,826,010	1,795,058	1,858,230
B2	2,385,700	2,521,341	2,510,000	2,273,000	2,497,313	2,514,067	2,464,990	4,800,000	2,875,103	N/A
B3	2,188,000	1,978,000	2,902,652	2,238,000	3,540,152	1,879,998	1,981,528	2,310,526	N/A	N/A
B4	12,217,634	8,972,284	6,670,545	7,971,937	7,767,866	N/A	N/A	N/A	N/A	N/A

It is not possible to determine the level of variance amongst the tenders by looking at the absolute figure thus the coefficient of variance (CV) is used as a tool to determine the level of variance from the data. Table 4.2 shows the CV of all four buildings based on the tender amount. The CV ranges from 15%-28%.

Table 4.2: Comparison of cv among conservation projects

No	Project	Mean	Std Deviation	CV (%)
1	Building 1 - Administrative	1,663,318	253,085	15.22
2	Building 2 - Institution	2,760,168	781,672	28.32
3	Building 3 - Fort	2,377,357	567,111	23.85
4	Building 4 - Administrative	8,720,053	2,119,169	24.30

It can be seen in the data above that Building 1 has a relatively lower CV than the other three buildings. The second lowest CV is Building 3 followed by Building 4. The difference between Building 2 which has the highest CV with the other three building is that the BQ of Building 2 is much simpler than the others with many items requiring the tenderers to decide and assume. It is also a Design and Build procurement system as compared with the traditional procurement system of the other three buildings.

Although the data is small but the intention of this small study is to verify if the anecdotal evidence is true in regard to conservation project tenders having high variance. As such, the data do provide an impression that there is high variance in conservation tender. It also hinted that the variance amongst tenders will be lower if tendering is conducted with a complete BQ. Given the lack of literature on tenders for conservation projects, this exploratory study is done to provide the answer that the issue of high variance is real and BQ could be one of the instruments to mitigate this problem.

4.2.2 Tender Comparison by BQ Section

The breakdown of the tender amount for each project was also collected to compare the pricing of each section of works in the tender as shown in Table 4.3, 4.4 and 4.5. However, there is no breakdown data for Building 1 because the tender documents have been destroyed after the project was awarded to the successful tenderer. Only Building 2, 3 and 4 have detail breakdown.

Table 4.3: Breakdown of tender amount for building 2

Item	Tender 1	Tender 2	Tender 3	Tender 4	Tender 5	Tender 6	Tender 7	Tender 8	Tender 9
Preliminaries	534,070	375,500	110,000	152,500	160,000	543,000	186,800	46,650	289,100
Conservation Works	1,073,690	1,664,741	1,850,000	1,370,500	1,750,000	1,119,334	1,743,190	4,420,293	1,985,783
New Works	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
External Works	446,600	346,300	200,000	150,000	250,000	200,805	275,000	15,000	470,220
M&E Works	311,340	134,800	350,000	600,000	337,313	650,928	260,000	318,057	130,000
PC and Prov Sum	20,000	-	-	-	-	-	-	-	-
Total	2,385,700	2,521,341	2,510,000	2,273,000	2,497,313	2,514,067	2,464,990	4,800,000	2,875,103

There is no new addition structure to the existing building and so the new works section does not have any amount. However, the section is included in the table to

indicate that it is not applicable and is not missing data. The item PC and Provisional Sum in the tender did not specify the type of work but only states "if any". Only one tenderer put in a price of RM20,000 for PC and Provisional Sum but did not state the work item. The tender price ranges from the lowest of RM2,273,000 to the highest of RM4,800,000 which is a difference of RM2,527,000. In other words the highest tender amount is 111% higher than the lowest amount.

Table 4.4: Breakdown of tender amount for building 3

Item	Tender 1	Tender 2	Tender 3	Tender 4	Tender 5	Tender 6	Tender 7	Tender 8
Preliminaries	224,635	116,477	484,730	248,000	865,306	200,000	630,260	754,850
Conservation Works	1,406,493	1,342,330	1,802,021	1,354,000	1,878,336	894,706	871,728	917,733
New Works	72,783	68,115	120,523	126,000	83,374	99,135	36,841	40,964
External Works	245,299	206,078	229,148	225,000	368,363	416,555	197,634	241,494
M&E Works	113,790	120,000	141,230	160,000	219,773	144,602	120,065	230,485
PC and Prov Sum	125,000	125,000	125,000	125,000	125,000	125,000	125,000	125,000
Total	2,188,000	1,978,000	2,902,652	2,238,000	3,540,152	1,879,998	1,981,528	2,310,526

The tender price for each section in the BQ for Building 3 has been filled as shown in Table 5.3. The prime cost and provisional sum has the same amount as this amount is provided in the BQ. The tender price for Building 3 ranges from RM1,879,998 to RM3,540,152 which returns a difference of RM1,660,154. In terms of percentage the highest tender is 88% higher than the lowest tender.

Table 4.5: Breakdown of tender amount for building 4

Item	Tender 1	Tender 2	Tender 3	Tender 4	Tender 5
Preliminaries	43,300	43,300	26,800	34,500	558,500
Renovation Works	8,987,389	6,021,235	3,790,443	4,801,637	4,799,822
External Works	55,003	155,003	74,851	119,494	119,494
Provisional Sum	1,270,000	1,270,000	1,270,000	1,270,000	1,270,000
M&E Works	1,761,942	1,482,745	1,308,451	1,246,307	1,020,050
Total	12,217,634	8,972,284	6,670,545	7,971,937	7,767,866

The breakdown by BQ section for Building 4 is shown in Table 5.4. In this tender all sections are filled and a provisional sum of RM1,270,000 is provided in the BQ. The tender price ranges from RM6,670,545 to RM12,217,634 giving a difference of RM5,547,089 which means the highest tender is 83% higher than the lowest.

By just comparing the difference between the highest and lowest tender amount the research is unable to determine the spread of variance among the tender prices. It is only an indication of the difference between two tenders, i.e. the highest and the lowest of the total tender amount. In the earlier analysis the variance of total tender amount among the project has already been calculated.

The following analysis looks into the variance between the different BQ sections by calculating the CV for each section of the BQ to identify the section that contributes to the high variance in the tender. For this purpose, only Building 2, 3 and 4 have the necessary breakdown of tender amount that is needed for the analysis. Due to the lack of complete information, Building 1 is omitted from the analysis that follows.

Calculation of the CV for the sections in a BQ will be done separately according to each building. The mean CV for each section of the BQ for Building 2 is shown in Table 4.6.

Table 4.6: Mean cv according to BQ sections for building 2

Item	Mean	Standard Deviation	CV (%)
Preliminaries	239,762.00	190,854.04	79.60
Conservation Works	1,697,753.11	1,117,424.20	65.82
New Works	0	0	0
External Works	261,547.22	144,045.22	55.07
M&E Works	343,604.22	179,644.25	52.28
PC and Prov Sum	0	0	0
Total	2,760,168.23	781,672.44	28.32

Building 2 recorded high mean CV for all sections in the BQ. Building 2 consists of restoration works to the housing quarters of a health institution. There are no new works and no P.C. and Provisional Sum in this contract. The project is procured using design and build method and the descriptions of the items in the BQ is the "all encompassing" style with many areas where the tenderers have to fill in their proposals for anticipated items of works. The overall mean CV obtained for the project is 28.32%. Preliminaries section recorded the highest mean CV of 79.60%. This means that the tender price for preliminaries among the tenderers has very high differences. The conservation works section also returns a high mean CV value of 65.82%. In fact, all sections in this tender have a mean CV of above 50%. This means that the dispersion among the tender prices is wide for all sections.

Table 4.7: Mean cv according to sections for building 3

	Mean	Standard Deviation	CV (%)
Preliminaries	440,532.25	283,782.19	64.42
Conservation Works	1,308,418.38	395,652.70	30.24
New Works	80,966.88	33,183.50	40.98
External Works	266,196.38	80,602.54	30.28
M&E Works	156,243.13	45,273.16	28.98
PC and Prov Sum	125,000.00	-	-
Total	2,377,357.00	567,110.78	23.85

Building 3 which is a fort also recorded high CV values for all sections in the BQ including the section for new works as shown in Table 4.7. The high CV for new works (40.98%) could be due to the nature of the project which is a fort. Nevertheless, this could not be verified in this research as it is outside the scope of this research to study the CV of new works. The P.C. and Provisional Sum consists of a fixed amount given in the BQ and thus recorded no CV value. The mean CV obtained for the entire project is 23.85%. The Preliminaries section has a CV of 64.42% being the highest among all sections. The Conservation works and External works have similar CV of 30.24% and 30.28% respectively.

Table 4.8: Mean cv according to sections for building 4

	Mean	Standard Deviation	CV (%)
Preliminaries	281,280.00	253,578.55	90.15
Renovation Works	5,680,105.17	2,010,716.83	35.40
External Works	124,769.08	33,074.43	26.51
Provisional Sum	1,270,000.00	-	-
M&E Works	1,363,898.86	277,352.14	20.34
Total	8,720,053.11	2,119,169.42	24.30

Building 4 is a government administrative building and the tender for this project returns a mean CV of 24.30%. The CV values for the different sections of the BQ are shown in Table 4.8. The CV for preliminaries section is the highest at 90.15%. This mean the pricing for preliminaries is not consistent and the variance is very high among the tenders for this section. Other sections have a much lower CV as compared to the preliminaries section. The Conservation Works section has a CV of 35.40% while the rest of the sections are in the twenties range. Similar to Building 3, the Provisional Sum section has no CV value as the amount is given in the BQ.

Table 4.9 shows the comparison of CV value of the different section of BQ among the project. B2 stands for Building 2, B3 for Building 3 and B4 for Building 4. It is found that the section of BQ with the highest dispersion is the Preliminaries bill followed by the Conservation works bill. The mean CV for Preliminaries is 78.1% which is almost double the mean CV of the Conservation works section at 43.8%. The reason for this cannot be ascertained by looking at the tender amount and need to be identified through the interviews.

The New Works in the same table refer to the new addition to the heritage buildings. Only one project has new addition to the building and the CV obtained is 41%. This is considered high when compared with conventional new build work. A closer look at the project reveals that the project is restoration to a fort and this may have an impact on the pricing level due to the unconventional construction method and design. However, this could not be verified in this research.

External works section shows the fourth highest dispersion and M&E works follow close behind. The PC and Provisional Sum section shows no dispersion because the amount is provided in the tender by the consultant and thus all tenderers will have the same amount.

Table 4.9: Mean cv according to BQ sections

BQ Section	B2 (%)	B3 (%)	B4 (%)	Mean CV (%)
Preliminaries	79.6	64.4	90.2	78.1
Conservation Works	65.8	30.2	35.4	43.8
New Addition Works	0.0	41.0	0.0	41.0
External Works	55.1	30.3	26.5	37.3
M&E Works	52.3	29.0	20.3	33.9
PC and Prov Sum	0.0	0.0	0.0	0.0

4.3 High Tender Price Variance in Building Conservation Project

While several researchers have analysed variability in tender prices for construction works (Fine and Hackemar 1970; Grinyer and Whittaker 1973; Quah 1992), their studies are not conducted on tenders for conservation works. Although the numbers shown in the above analysis is rather high, it may be questioned if such variance amount is the norm in the industry? If it is so, then it would be wrong to say that conservation works tender has high variance. In order to determine the normal level of variance among tender amount in the industry, a comparison will be done with the new building works. As new building works has the highest volume of work in the construction industry, it is deemed to be representative of the norm in the industry. The CV of new build works used in this comparison is derived from a sample of new build works tender obtained from quantity surveying consultancy firm.

In addition to new build works, data on refurbishment works obtained from literature review is also used to compare with conservation works to provide an indication of the level of variance for conservation works as compared to other type of works. Quah (1992) in his study, compared the variability between various studies using mean coefficient of variation (CV) and found that the mean CV of different building projects ranges from 5% - 8.4%. The building projects consist of government institution contracts, building contracts, construction contracts, civil engineering works contracts and refurbishment contracts. A random comparison of variability for new build works in this country also found that the CV ranges from 5% -7% and the mean CV of 6.5%.

Table 4.10: Comparison of mean cv between conservation and new build project

No	Project	Mean CV (%)
1	Conservation Project	22.92
2	New Build	6.50
3	Quah (London,1992) Refurbishment Works	7.50

By using CV as the comparison tool, it is logical to say that the lower the number the better it is as low CV shows low variability and thus infer that the tender prices are close to each other and this can be construe as competitive. As there is no known acceptable range of CV for variability between tenders, a comparison is conducted with other type of works. Table 4.10 compares the mean CV of conservation works with Quah (1992) and new build works. The comparison shows that conservation works has a mean CV of 22.92% which is much higher than Quah's (1992) mean CV for refurbishment works of 7.5%. A sample taken for new build works provided a mean CV of 6.5% which is also lower than the mean CV for conservation work. The mean CV for the new build works provides a perspective on the variability in the local context because Quah (1992) data reflected the situation in London at a different time. The result shows that conservation works tender do return a much higher variance than new build works or even refurbishment works.

In addition to the comparison of the overall tender amount among different type of works, a comparison between the mean CV of conservation works and new build works for the different sections of BQ is also presented here in order to see the magnitude of differences as shown in Table 4.11.

Table 4.11: Comparison of mean cv by BQ section between conservation and new build works

	Conservation (%)	New Build (%)
Preliminaries	78.1	19.3
Conservation Works	43.8	0.0
New Addition Works	41.0	0.0
Building Works	0.0	10.8
External Works	37.3	22.7
M&E Works	33.9	17.3

Table 4.11 shows that although Preliminaries is similarly difficult to quantify for both type of work, the dispersion is very much higher for conservation works as compared to new build works. Therefore, further study is recommended on this section of the BQ to identify the cause for such high dispersion among the different tender amounts. The sections of conservation works, new addition works and building works are exclusive to either conservation or new build projects only and thus could not be compared.

For the sections of External Works and M&E works in conservation tender, the mean CV is still higher than the same section for new build tender. However, the difference shown is not as big as Preliminaries. Overall, the highest mean CV in new build works is still lower than the lowest mean CV for conservation works. This shows that generally the variability in conservation works tenders is very high, thus further probing is needed to identify the problems that could have caused such high dispersion. This observation will be asked during the semi-structured interviews for further confirmation and reason for the occurrence of this phenomenon.

4.4 Semi-structured Interviews

Upon identifying the variance of actual conservation project tenders, the research proceeded to collect data from semi-structured interviews. The semi-structured interviews are conducted to determine the reasons for the high variance, the adequacy of the bill of quantities in terms of the format and information for the tenderers to price and the final part is to identify the suitable and relevant format of BQ for conservation projects. The sampling frame was derived from the list of tenderers obtained from Local Authority, JKR and Jabatan Warisan that have conducted tendering exercises for conservation project. This is because there is no formal registration of contractors that are involved in building conservation works. The samples that were successfully interviewed are contractors whom have completed restoration works to heritage buildings. Their experience in conservation works ranges from 1 year to 20 years with an average of 10 years. Each interview lasts about an hour and was recorded. The interviews were transcribed after the interviews and the transcripts are analysed using thematic analysis. The transcripts are coded and themes and sub-themes are drawn out from data to form the findings from the survey.

4.4.1 Thematic Analysis of Interviews Data

The transcripts are manually coded and the coded parts of the transcripts are then extracted to a summary to identify the themes. The summary of the data extracts are grouped according to the main questions which are a) reasons for differences in tender price, b) adequacy of the bill of quantities and c) ideas for improvement to the bill of quantities. The summary of the coding and themes arising from the question on reasons for the differences in the tender price is shown in Table 4.12. In order to facilitate the interviewees, some of the interviews are conducted in Bahasa Malaysia. Therefore,

some of the transcripts are in Bahasa Malaysia with the translation in italics beside the actual transcript.

The table 4.12 shows the themes pertaining to questions asked about the reasons for the major differences that occurred among conservation project tenders. Relevant responses from the interviewees are extracted from the transcripts and grouped together according to the codes assigned. The codes expressed the reasons that will answer the question. The codes are given directly based on the answers in the transcript and from Table 4.12, it can be seen clearly that there are many codes that are similar which can be further converge into one theme. This preliminary analysis provides insight into the reasons that may cause variance in the tender price based on the respondents' opinion. The respondents' reasons for the variance focus on "unknown works/damages", "incomplete BQ", "manpower and material" and "inexperienced in conservation works". There are also other opinions such as "profit margin", "scope of work", "age of building" and "design and build procurement". However, these latter opinions are in the minority.

Table 4.12: Coding for reasons for the differences in the tender price

Data extract	Coded for
R1 agreed there are big differences between tenders. The range depends on the profit margin.	Profit margin
R1 states because in renovation works, you don't know what is inside. Once we pull out then only we know what is inside.	Hidden works
R2 state difference is above tolerable range due to cost of manpower and material. Big difference due to cost in using manpower and material (R2)	Manpower and material.
We do face problem getting the pricing for the actual material (R7)	Problem in pricing actual material

Table 4.12: Coding for reasons for the differences in the tender price (continued)

Data extract	Coded for
Difference scope of work from normal construction. (R2)	Scope of work.
R3 state the difference is within reasonable range due to experience in foresee hidden works. As an experienced restorer, we will foresee, anticipate…(R5)	Experience.
Many general contractor that doesn't know so they will price cheaper (R4) Inexperience (R4, R9, R10)	Inexperience
Price based on assumption (R5) Not familiar with BQ (R3) Unfamiliar with specification (R1,R2) Unfamiliar with conservation method (R1, R2, R4, R5) Unfamiliar with material (R1) Not familiar with repair method (R5)	Unfamiliarity
R7 indicates that there is a lot of unknown factors so contractor either they become very conservative or if they also sometimes really want the tender, they can price it too low.	Lots of unknown factors
For the tenderers that detected the damaged works, the cost will be included in the tender but for tenderers that did not detect that, then they will not price in the cost and this cause differences in the tender amount(R5)	Unknown damages
Kalau tak buka tengok building tak tahu (If the works are not opened up, do not know the works/damages) (R8)	Unseen works
Roof tie is damaged but have to remove the whole roof to repair (R5)	Not familiar with repair method
The BQ is not clear that is why you have such discrepancies (R6) *BQ item kurang complete dari segi tatacara kerja* (BQ item is incomplete in terms of work procedures needed) (R8)	BQ not clear
R1 mentions that BQ prepared for conservation works are not reflective of all the works needed (R1) *Orang yang prepare BQ tidak lengkap* (The BQ is not complete) (R10)	BQ not complete
For slate tiles, just only one supplier and sub-contractor don't know how to install it so this will be causing the price difference also. (R10)	Material cost

Table 4.12: Coding for reasons for the differences in the tender price (continued)

Data extract	Coded for
Some will assume and allow in and some don't (R6)	Missing items
No method statement that is why you can see a lot of price variation (R6) *Tak akan dapat sampaikan maksud yang sama jadi kontraktor memperhargakan tak sama* ([The description] could not deliver the same meaning so contractors will price differently)(R10)	No method statement
The older the more expensive and more gap in price (R8)	Age of building
Don't understand need of statement, didn't follow need of statement, hard to find materials (R10)	D&B tender

The table 4.13 shows the themes pertaining to questions asked about the adequacy of the bill of quantities that is currently prepared for conservation project tenders. The questions focused on the adequacy of format and information that will assist the tenderers in their pricing process. Again, relevant responses from the interviewees are extracted from the transcripts and grouped together according to the codes assigned. The summary of the coding and themes arising from the question of adequacy of the bill of quantities is shown in the said table. The transcripts are analyse according to the sections of the BQ and issues pertaining to each section are extracted by coding it. The preliminary analysis found that adequacy of BQ focus mainly on issues such as conservation related items are not included in the preliminaries section, e.g. "archaeology find", "suitable material for protection of existing works" and "rate for fixed items". The measured works section is also found to be "incomplete" and "no standard format". The analysis also found that specifications are not conservation related. In the opinion of the respondents, this will hinder the accuracy of tender pricing. However, this preliminary analysis has too many diverse codes which need to be further converge to obtain a better focus on the major issues on adequacy.

Table 4.13: Coding for adequacy of bill of quantities

Data extract	Coded for
You do external work after one year so the pricing already run…better to change to PC Sum (R1) Increase detail in external works(R2)	External Works
Preliminaries too thick (R1) Preliminaries no need to change (R2) More detail and reduce copy and paste items(R3) Some things not necessary to put inside (R3) Preliminaries cover quite a lot of things and should be higher to cover whatever is not seen(R5) Preliminaries should be more detail (R6) If no detail it will be difficult to compare cos you do not know what is included in the price (R6)	Preliminaries
Has to be more detail for heritage works. It depends on individual projects. It is not a standard preliminaries (R7) Maybe just add some items specific to conservation(R7)	Detail and bespoke preliminaries
Preliminaries kena buat special, specific untuk kerja conservation (Preliminaries need to be special, specific for conservation works) (R8)	Separate preliminaries
Adakan satu klausa supaya kalau terjumpa apa-apa, apa perlu buat (To include one clause stating the procedures if things are found) (R8)	Clause on archaeology finds
Kena tulis dalam preliminaries kena protect dengan apa bahan (Have to write in the preliminaries the type of material to use for protection)(R8)	Specify protection material
Bagi satu kadar harga untuk a few items yang memang dah tahu harganya fix (Provide a schedule of rate for the few items that is known to have a fixed price)(R9)	Rate for fixed items e.g. conservator
Increase detail in BQ and external works(R2) BQ as detail as we can (R3) The more they put in is fair to everyone(R4) R5 states need detail in BQ BQ sequencing is important, lebih (*more*) detail(R9) *Dalam conservation tak ada "or equivalent"* (In conservation there is no "or equivalent")(R9)	More details in BQ

Table 4.13: Coding for adequacy of bill of quantities (continued)

Data extract	Coded for
Firm quantity for BQ (R1) (R2)	Firm quantity
BQ did not describe in details the works. Need more detail descriptions.(R1) R3 agreed that BQ has missed out certain works. They don't allow for, they themselves don't know also (R6) R5 states BQ did not specify test Description mostly not complete and not clear (R3) Didn't write description in detail. Description mostly not complete and not clear.(R2) Description not clear (R6) Inaccurate BQ (R7) Description not specific (R7)	Incomplete BQ Missing work item Incomplete description
No standard format.(R1) No standard format. Depend on site.(R2) ..some write in English, some in Malays, in between using English and then Malay again…(R3) .. don't think there is standard format. (R4) There is no format, it depends on how experience is the architect (R5) Umbrella format, they just put in a clause to cover everything (R5) *Tak ada* (not available) standard format …nobody control the consultant (R7)	No standard BQ format
Arrangement of BQ – quite confusing…sometimes we miss to *tengok macam* (see such) small thing (R3)	Confusing arrangement of BQ
No specification, preambles and method statement makes it difficult to price.(R1) (R2) *Orang yang menyediakan document itu cut and paste* (The person preparing the documents using cut and paste)(R10) Specification most of it incomplete and irrelevant (R6) Specifications are cut and paste and hardly specific for conservation works (R7) Specification not complete (R3) No standard specification for conservation works (R9)	Specification not specific to conservation works Specification not complete and not standard

Table 4.13: Coding for adequacy of bill of quantities (continued)

Data extract	Coded for
If we don't understand about the conservation, it will be difficult for any BQ to prepare.(R1) This one the conservation different. Different steps.(R2)	M&E Works
Overseas material to be in PC Sum (R2) Salt desalination and rising damp was put in as PC Sum(R7) Salt, rising damp, termite *masuk dalam* (included in) PC Sum(R9)	Prime Cost Sum
No need so much provisional sum(R3) For provisional sum, items for unforeseen work(R6)	Provisional Sum
They didn't mention what is HABS so they didn't give us the format of HABS(R3)	HABS
They ask us to give a schedule of rate(R4)	Schedule of Rate
R5 states to fix P&A for PC Sum	Profit & Attendance
There should be a standard acceptable range and where to test. If testing is done overseas, will be more expensive(R6) Lab test should cover existing and new plaster to compare (R6)	Testing
We should specify from which gridline to which gridline(R6)	Description style
Should be done before the tender(R7) Dilapidation report not detail (R7)	Dilapidation report
The best method is more design and build (D&B)(R7) *D&B bagus tapi kos tinggi*. (D&B is good but high cost) (R9)	Design & Build
Ada dua tiga kelemahan dalam kita punya specs (There are two to three weaknesses in our specs [specifications])(R8) *Ada banyak lagi specs yang kita boleh buat* (There are much specifications that we can write)(R8) *Kena sit down dengan conservator untuk mendapatkan specs lebih bagus* (Have to sit down with the conservator to produce better specifications) (R8)	Weak Specification
Kita kena ada firm BQ and juga ada pengukuran semula (We need to have firm BQ and also remeasurement BQ) (R8)	Combined BQ

Table 4.13: Coding for adequacy of bill of quantities (continued)

Data extract	Coded for
Actual damage itu dapat come out dengan pricenya (Actual price of actual damages can be calculated) (R8)	Pricing actual damage
Termasuk juga method statement, kena come out dengan satu resolution macam mana nak perbaiki damage (Included in the method statement, there should be a resolution on how to repair the damages) (R8)	Method statement
Kos tak dapat nak anticipate sekiranya pergi luar negara untuk cari bahan binaan (The cost cannot be estimated if the materials have to be sourced from overseas) (R8)	Overseas materials
Perlu tambah ialah kajian penyelidikan (Need to add research study) (R10)	Research study
Mesti ada garispanduan (Must have guidelines)(R10)	Guidelines
Dalam kerja konservasi perlu ada kelonggaran masa (In conservation works, time need to be flexible) (R10)	Allow extension of time

The table 4.14 shows the themes pertaining to questions asked for ideas and suggestions to improve the bill of quantities for conservation project tenders. Similar to the steps used above, relevant responses from the interviewees are extracted from the transcripts and grouped together according to the codes assigned. The summary of the coding and themes arising from the question of "suggestions for the proposed guideline for conservation bill of quantities" is shown in Table 4.14.

The suggestions given are coded according to the different sections of the BQ and analysis on this part of the transcript yields findings on sections of "preliminaries', "measured works", "prime cost and provisional sum", "method statement", "dilapidation report" and "historical architectural building survey report". Other codes found in this part covers "archaeology test pit", "specification" and "conservationist". Further analysis will be conducted to obtain information on improvements that are needed.

Table 4.14: Coding for proposed guideline of conservation bill of quantities

Data extract	Coded for
Preliminaries sudah kira detil (Preliminaries are already quite detail) (R9) *Item preliminaries yang lain daripada test pit boleh jadikan compulsory* (Preliminaries items other than test pit can be made compulsory) (R9) Add clause on archaeology findings (R8) Specify protection method (R8) *Preliminaries kena buat special, specific* (Preliminaries have to be special, specific) (R8) *Bagi satu cadangan untuk protection of interior* (Provide a suggestion for the protection of interior) (R8) Has to be more detail. Not a standard preliminaries. Has to consider addition requirement i.e. traffic management working space. Add items specific to conservation. (R7) Other prelims items, ok but protection of interior depends on project (R7) Temporary structs in the prelims (R7) Prelims should be more detail (R6) Add in items specially for conservation works (R5) Material testing should be in preliminaries. State acceptable range and where to test (R6), Should have comparison test between new and existing plaster (R6) More details and reduce copy and paste items (R3) Preliminariess no need changes (R2) *Lawatan penyelidikan perlu* (Need research trip)(R10) *Perlu masuk teknikal visit* (Need to include technical visit) (R9) *Masuk kos teknikal visit* (Include cost of technical visit)(R8) *Awareness signboard mesti ada* (Should put up awareness signboard [at site]) (R10)	Preliminaries

Table 4.14: Coding for proposed guidelines of conservation bill of quantities (continued)

Data extract	Coded for
Bagi contact supplier, range harga, senarai konservator (Provide suppliers' contract, price range and list of conservator) (R10) *Bagi satu kadar harga supaya kontraktor tak underpricing* (Provide a schedule of rate so that contractor will not underprice) (R9) Remeasurement Bill (R10) Firm Bill (R1, R2, R6, R9) Firm and remeasure depends on items (R8) BQ is better than lumpsum (R4) Combined firm and remeasure (R3) Mostly no remeasurement (R7) Sequencing of BQ is important (R9) More details, door and window cannot by number (R9) No "or equivalent" (R9) Need to know actual damage and how to repair it (R8) Some description is not clear (R6) Should describe by gridline (R6) Must ascertain on site for more details (R5) Provide schedule of rate for negotiation of price (R4) More detail is fairer (R4) As detail as possible (R3) Add protection in BQ (R3) Protection in BQ (R2) BQ to be more detail (R2) Temporary roof cover in BQ (R20	BQ Additional information to be included in BQ. Rates information to be included
Test pit archaeology bergantung kepada bangunan ([Requirement of] Archaeology test pit depends on the building)(R10) *Test pit mesti lebih besar dan layer by layer* (Test pit must be bigger in size and layer by layer) (R10) Requirement for it depends on the conservation work (R7)	Test pit archeology

Table 4.14: Coding for proposed guidelines of conservation bill of quantities (continued)

Data extract	Coded for
Specs tidak sesuai tetapi garispanduan boleh (Specification is not suitable but guidelines is suitable) (R10) Improve the specifications (R8)	Provide guidelines instead of specifications
P.C. and Provisional Sum to add specialist work (R9) Salt desalination and rising damp put in P.C. Sum (R7) Have items for unforeseen work (R6) Reduce P.C. and Provisional Sum (R3) Ordering of materials from overseas include in P.C. Sum (R2) Prefer no P.C. and Provisional Sum (R2) External works to convert to P.C. Sum (R1)	P.C. and Provisional Sum Add specialist work
Produce method statement (R8)	Method Statement
Dilapidation report is done before tender (R7)	Dilapidation report
HABS to be in new section (R3)	HABS
Conservationist in Main Works Bill	Conservationist

Analyses of the above tables are discussed in the sections below.

4.4.2 Causes of High Variance in Tender Amounts

During the interviews, the questions asked are according to the parts in the questionnaire. In the first part of the interviews, interviewees are asked if there is a big difference in the tender amount among different tenderers. Following from the responses, questions are asked to probe for the high variance in the tender amount. The findings from the interview data are tabulated in Table 4.15 and discussed below.

Table 4.15: Respondents perception and reasons on high variance of tender amounts

Respondent	Answer	Coding for Reasons of High Variance
R1	Yes	Hidden works BQ not complete
R2	Yes	Labour & material cost
R3	Yes, some	Not familiar with BQ
R4	Yes	Inexperience
R5	Yes	Price based on assumption Unknown damages
R6	Yes	BQ not clear
R7	Yes	Lots of unknown factors
R8	Yes	Age of building Unseen works
R9	Yes	Inexperience
R10	Yes	Inexperience Material cost Design & Build

The finding shows that all interviewees agreed that there is high variance among the tenders for conservation project. This affirmation by the respondents supported the findings of the analysis in the first part of this research that indicates high variance among tenders in conservation works. Using thematic analysis, transcripts of the interviews are coded at the parts where the interviewees provided reasons for the high variance. Themes pertaining to the high variance question are elicited from the coding.

On the first round of thematic analysis, answers from the respondents provided the following reasons. Respondent R1 and R5 mention that hidden works/damages and incomplete BQ that causes high variance in the tender amounts. Respondent 7 and 8 also indicate that lots of unknown factors and unseen works contribute to the high variance. Respondent R6 also mentions that high variance is due to BQ that is not clear. This means that cost for the required works is not included in the BQ and due to incomplete information in the BQ, the tenderer may also put in a higher mark-up to cover for higher risk. Respondent R5 also indicate that tenderers priced based on assumptions and as different tenderers have different assumptions, the variance among

tender price will be high. Respondent R2 explains that the variability is due to the labour and material cost. As the type of labours and materials that are needed may be different from new build, the cost of the labours and materials are not known to all tenderers and thus this creates higher variability among tender amounts. Respondent R10 also included labour and material cost as one of the reason for the high variance. Respondents R3, R4, R9 and R10 mention that tenderers inexperienced in conservation works would not be able to price accurate as they lack information on the labour, material and time needed to complete certain restoration works. Respondent R8 and R10 also mentioned two other factors that they opined is the cause of high variance which is the age of the building and also design & build procurement.

Once the first stage of themes are obtained, the analysis will proceed to the second round where themes that are similar will be combined to form a more generic theme. The second round of coding is shown in Table 4.16 below. Analysis from the second round found four major themes emerging which are 'hidden works', 'labour & material', 'inexperience' and 'BQ'.

The coding of "hidden works", "unknown damages", "lots of unknown factors" and "unseen works" are grouped together under "hidden works". Due to the nature of conservation works where it is restoring/repairing an existing building, it is common that there are damages that cannot be seen easily especially if it is being covered by many layers of repairs throughout the life of the building. As such, during the tender period, demounting works has not started and thus the "unknown works/damages" is not seen and would not be included in the BQ. However, an experienced tenderer may be able foresee the damages and may have included the cost into the BQ by way of mark-up in the rates.

The final coding of “labour and material” is derived from the preliminary coding of “manpower & material cost”, “material cost” and “problem in pricing actual material”. This reason is a logical cause of high variance as the tender pricing is derived from the cost of labour, material and plant. Inability to forecast the price of labour and material will naturally affect the tender amount.

The reasons of “inexperience”, “price based on assumption”, “unfamiliarity” and “different scope of work” are grouped under “inexperience”. The relatively new interest in conservation means that the knowledge and skill in conservation works and pricing for such works is still lacking in the industry and thus the contractors that venture into this field is still learning as they work.

The respondents also identify issues with BQ as one of the reasons for the high variance. The issues are “BQ not complete”, “BQ not clear”, “missing items” and “no method statement”. The missing items here pertain to BQ of conservation works that did not include the complete works that is needed on site. This reason is related to the above reasons of “hidden works” and “inexperience” that may cause certain work items to be missed out from the BQ.

There are three reasons that are exception, i.e. ‘profit margin’, ‘age of building’ and ‘design & build procurement’. These three reasons are denoted as exception because only three respondents (one for each reason) mentioned these reasons as one of the causes of high variance.

Table 4.16: Preliminary and final coding for themes

No	Preliminary Coding	Final Coding
1	Hidden works (R1) Unknown damages (R5) Lots of unknown factors (R7) Unseen works (R8)	Hidden works
2	Manpower & material cost (R2) Material cost (R10) Problem in pricing actual material (R7)	Labour & material
3	Inexperience (R4, R9, R10) Price based on assumption (R5) Unfamiliarity (R1, R2, R3, R4, R5) Different scope of work (R2)	Inexperience
4	BQ not complete (R1, R8) BQ not clear (R6, R8) Missing items (R8) No method statement (R6)	BQ
5	Profit margin (R1) Age of building (R8) Design & Build (R10)	Exception

Literature has shown that variance in tenders can be due to various factors and this study shall identify the reasons that conservation work tenders have such high variance. The themes provide insight into the reasons for the high variance in the tenders. The issues mentioned above show that there is a gap in the knowledge that is needed for contractor to price competitively. In order to delve further into each theme, the sub-themes that are related to each particular theme are identified and discussed below.

4.4.2.1 Hidden Works

Literature did not identify hidden works as a factor that contributes to variance in the tender amounts. Study on factors influencing tender pricing thus far is done on new build works (Buchan et al., 2003). In new build works, the issue of hidden work does not arise as there is no building yet and thus no work is being hidden. In addition, details and information for the project of new build works are also given in drawings and documents to facilitate the contractor in pricing and construction. This is one of the

differences between conservation and new build works. The sub-themes of 'Hidden Works" provide further insights into how this factor contributes to the high variance. The sub-themes are as shown in Table 4.17.

Table 4.17: Sub-themes for "hidden works"

No	Sub-themes
1	Condition of existing building
2	Lack of site study
3	Test not yet conducted
4	No access to site
5	No clear method statement

In new build works, contractors will be able to obtain information on the scope of work from drawings and tender documents. On the contrary, information for conservation works is highly dependent on the condition of the existing building and usually damages may be unknown during tendering period. Due to the nature of conservation works which is repairing and restoring an existing and usually damaged building, there exist unknown conditions of the building which are covered by the layers of construction works throughout the years. This unknown work is one of the reasons that contractors cite for the variance in tenders. Contractors with experience may include a higher mark-up to cover these hidden works while newer contractors may not have the foresight and therefore did not include costs for the hidden works and thus may inadvertently submit a lower price. This issue is explained by the respondents R1 and R4 as shown below.

Respondent 1: 'You don't know what is inside. Once we pull it out then only we know what is inside (the walls of the building).'

Respondent 4: ‘So those things we would not know will happen when we get the job so when we price we anticipate, sometimes we are right, sometimes we are wrong.’

The requirement for testing in conservation works also contributed to this problem. The principle of conservation work is to restore the building to its original conditions and since the original conditions is not known by looking at it, tests are needed. However, the tests are usually done during the construction period and thus the information is not available during the tendering stage. Due to such missing information, the contractor would have to make assumptions and this will affect the contractor’s ability to price competitively. Respondent R2 explains this problem, ‘One thing before you hack, you must prepare the method statement and when you hack, you must get a few samples of the plaster and send it to the lab for content analysis to see if it is cement, lime or red sand – you also don’t know because the BQ sometimes never mention.’

The interviews data show that insufficient information causes uncertainty and this uncertainty is reflected in the high variance of tenders. Those that foresee hidden works will price high to cover the costs while those that do not will price according to the works shown in the BQ which did not include the hidden works.

The issue of hidden work is not new in conservation. This is one of the characteristics of conservation works that is similar to refurbishment works (Quah, 1992) where the full extent of work may not be fully realized until demounting works are done. Similar to refurbishment works, conservation of heritage building usually encounters unexpected works after the existing parts are removed or dismantle for repairs as explained by respondent R3, “When we dismantle the roof, we found that the

original roofing is slate and so the conservator insists to use slate. This has changed the scope of work for the contractor which he totally did not anticipate at all during tendering". Although both types of work is similar, the difference between refurbishment works and conservation works lies in the age of the building. Usually refurbishment work is executed in relatively new buildings which are not regarded as heritage buildings. Additionally, in refurbishment works, usually there is no requirement to restore the building back to its original condition or to use the original materials. Therefore, the contractor can always suggest similar materials that are less expensive while conservation works require restoration to original materials which may be costly if the source is limited.

When information is insufficient and not included in the BQ, it will affect the contractor's ability to price competitively during tendering. This means that insufficient information causes uncertainty during pricing and this uncertainty forces the contractor to make his own assumptions. When different contractor makes different assumptions, the price will vary due to the differing assumptions and this may influence the overall tender amount. Those that assume there are more hidden works will price it higher to cover the costs while those who do not will price according to the BQ which may not have included the hidden works. The importance of sufficient information for pricing is shown in the studies by Ling and Boo (2001) and Ajibade and Pasco (2008) where they found that the most effective method of improving estimating accuracy is when there is sufficient information available at the time of estimating.

4.4.2.2 Inexperience

The interviews data also found that familiarity with specification, method of conservation and materials used is important to enable the contractor to price the tender competitively. Sub-themes for "Inexperience" are as shown in Table 4.18.

Table 4.18: Sub-themes for "inexperience".

No	Sub-themes
1	Pricing based on experience
2	Unfamiliar with repair method, specifications, materials
3	Unsure of the conservation method
4	Unable to foresee required work

Experience is the skill or knowledge in something that is obtained from doing a certain task. In this case, the experience needed is the skill to price accurately for conservation works as well as the knowledge in the method of conservation. When a contractor does not have sufficient experience in conservation works, it may cause the tender price to be higher as explained by the following respondent.

Respondent 4: 'When we are not sure how to do the work, we price higher.'
Respondent 7: 'We based on judgment to price. That is why conservation prices differ and big range.'

However, the survey also found that once the contractor has experience in conservation works, it will be easier for him to price as explained below from an excerpt of the transcript of R2.

Interviewer: 'If you are not familiar with the construction method in construction work, will that give you a problem in pricing?'

Respondent 2: ‘For the first time is difficult.’

Interviewer: ‘Once familiar, there will be no problem?’

Respondent 2: ‘Yes.’

Interviewer: ‘What about not being familiar with materials used for conservation works?’

Respondent 2: ‘Same with the earlier. First time for everyone is also difficult.’

Another excerpt from respondent R4 also explains that contractor with experience in conservation works will be able to price better while a new contractor will price the conservation works BQ in the same way as pricing for the construction of a new building. If a contractor uses the same pricing rates from new build works for conservation works, the tender amount calculated may not be reflective of the actual cost of works.

Respondent 4: ‘Those that have done before, they will know what it takes, those that have never done before, definitely they will price it like a new building, this (conservation) is completely different you know.’

This indicates that with experience, the contractor will be able to foresee and anticipate the works required and thus be able to price competitively. When inexperience contractor price for conservation works, they might not foresee the meticulous steps needed to perform the work to ensure that the authenticity of the building is protected. As such, the contractor will submit a lower price as compared to an experience contractor that has included the cost of the additional work. Respondent R3 explains it as follows.

Respondent 3: ‘When you install air-conditioning, you need to have the piping running around the wall. For conservation works you need to have a clear method statement on how you hack the wall, fix the piping, make good and return the condition of the wall to the original form. Some contractor can’t foresee this part and they price like an air-conditioning installation in a new building.’

In the study by Shash and Al-Khaldi (1992), they have also identified that previous experience of the contractor on the type of project is a major factor contributed to the accuracy of cost estimates for tender. Similarly the study by Al-Harbi, Johnston, and Fayadh (1994) have also identified that lack of experience in similar job ranked 11 out of the 20 problems that is faced by cost estimators. Therefore, it is not surprising that with the contractors being new to conservation works in this country, their lack of experience in pricing such works has caused the high variance among the tenders. This problem is also similarly experienced in refurbishment works where Quah (1991) mentioned that time and experience alone will minimize risk.

4.4.2.3 Bills of Quantities

Bill of Quantities (BQ) is one of the themes that emerge from the analysis of the interview data. The sub-themes arising from this main theme includes BQ that are inaccurate and not clear, lump sum quantities and all-encompassing description found in the BQ as shown in Table 4.19. This is one of the weaknesses of BQ that contractors contributed to the variance in tenders.

Table 4.19: Sub-themes for "BQ"

No	Sub-themes
1	BQ is not clearly written
2	Lump sum quantities
3	All-encompassing description
4	Inaccurate BQ

Excerpts from the interviews indicate that discrepancies are due to BQ that are not clear. Respondent 6: 'Because the BQ is not clear, that is why you have such discrepancies.' Respondent 8: 'We don't get accurate BQ.'

BQ consists of both descriptions and quantities and both of these are equally at fault in hindering contractors from pricing accurately. Quah (1992) has identified the same poor work descriptions as one of the major complaints in refurbishment tender. When descriptions are not clear, the contractor will have to make their own assumption and different contractors will be having different assumptions which will lead to different pricing.

Respondent 3: 'Some of the items they copy and paste and they didn't write it in detail.' Respondent 7: 'We based on judgment to price. That is why conservation prices differ and there is big range (among tenders).'

Similarly if the BQ uses many all-encompassing descriptions, the contractors are force to price higher because such description includes everything and not only those works that is needed in the given item. Therefore, some contractor will include more and some less. When this happens the difference will be high and the price is no longer comparable on an apple to apple basis. The same study by Quah (1992) also found that inadequacies was covered by using "all embracing" risk clauses in the tender documents

which created higher risks. Tenderers that perceive the level of risks differently will mark-up differently thus creating a big variance between tenders.

Respondent 4: 'As I say most of them (QS) try to be very safe, they will put everything inside (the BQ description).'

Respondent 5: 'As I was saying just now, it's an umbrella one (description). It covers everything. For example, to replace whatever rotten timber in the roof trusses.'

The problem is not always the high unit rate but the total costs that each contractor allows for the required works that is different. This is due to the reason that no quantities are given to guide the contractors but are only asked to price as lump-sum. When this happen, the contractor will measure his own quantity and this will again cause differences between contractors. This factor is also found in Kodikara et al. (1993) study where they suggest that the information stored in the BQ should be arranged in a directly useable way and it was found that, 'quantities', 'quantity units', and 'unit rates' are the key elements of the BQ information that need to be presented in a more meaningful format.

Respondent 6: 'Second weakness is, it is all in lump-sum. Of course there are some they can't measure but they (descriptions) are not specific, e.g. just make good existing wall but there is no detail (on the method and quantity).'

Even when quantities are given, there are problem as the quantities given are only provisional which has a higher risks and therefore forces the contractor to allow for a higher mark-up in their pricing. A study by Quah (1992) also found that refurbishment

tenders have a higher provisional sum contents. Depending on the ability of each contractor to carry the risk, the mark-up will differ (Stone, 1983). This has caused a high discrepancy between the tender prices among tenderers as well as cost over-runs during the construction period.

Currently, BQ for building conservation tender is prepared based on the conventional sequence following new build work. However, as the sequence of work for building conservation work is different from new build work, the current arrangement makes it difficult for the contractor to ensure his pricing did not missed out any related works. It is evident from the interviews data that the current bill of quantities for conservation work is poorly prepared. The effect of a poor bill of quantities is that it forces the contractor to make assumption when pricing which may inflate or deflate the price unrealistically. However, one respondent explains that if the BQ is well prepared it will be of help to inexperience contractors.

Respondent 1: 'Not familiar with the type of work will be difficult to price but if the BQ is clear then it will help.'

Thus, bill of quantities that are well prepared with complete description, accurate quantities and proper sequencing will provide standard basis for the pricing of tenders. Kodikara et al. (1993) found that in order to use the data in a BQ, 50% of the BQ requires some form of re-working, i.e. modification or breaking up of data when the data is being used. This shows the importance of having a useable format of BQ for more efficient use of data for estimating.

4.4.2.4 Labour and Material Cost

Labour and material cost has been identified by (Buchan et al., 2003) as factors that influence variability in tenders. The interviews data also suggests the same as one of the reasons for high variability in conservation works tender. The theme of 'labour and material' does not have any sub-theme. This could be due to the self-explanatory nature of the theme where the problem of pricing pertains to the costs of material and labour. If the tenderer did not foresee the use of specialised labour or considered the difficulty in the supply of heritage materials then the tender may be under-priced.

The labourers for conservation works is usually highly specialized and are skilled craftsmen. In addition, the work is meticulous and time consuming. If the contractor did not take into consideration the need to engage skilled craftsmen or the need to source skilled craftsmen from overseas, he may have under-priced the tender.

Respondent 1: 'You must have a good labourer who knows how to refurbish back so the labour cost is quite high. Also because they do by hand and not by machine, so it is slow.'

Respondent 2: 'The big difference is the cost of using manpower and material because the scope of work is different from normal construction.'

Material poses a different set of problem for conservation works because of the difficulty in obtaining original materials for the conservation works. Many of these materials are obsolete and to request the factory to reproduce the same materials, e.g. floor tiles would be very expensive. One respondent explains the problem with materials.

Respondent 2: ‘There are cost overruns because of the materials – we have to order from somewhere in Indonesia.’

The requirement to use original materials according to the age of the building has also caught new contractors off guard when they price with the unit rate of new material and later found that the price of original materials is much higher due to the scarcity of supply. This infers that both labour and material has a higher risk in conservation works and so tenderers would have to managed this risk ably to ensure that they do not under-priced these two items. This is slightly different from refurbishment works where labour is perceived as carrying a higher risk than new build but material is perceived to have the same risk as new build (Quah, 1991).

4.4.3 Discussion on Reasons for High Price Variance

The themes obtained from the semi-structured interviews provide insight into the reasons for the high variance among conservation project tenders. The analysis of the interviews found that Unknown (Information), Experience, Document (Bills of Quantities) and Technical Issues (Labour and Material Cost) contributed to the difficulty in pricing the tenders. A diagrammatic sequence of the thematic analysis is shown in Figure 4.1, Figure 4.2 and Figure 4.3.

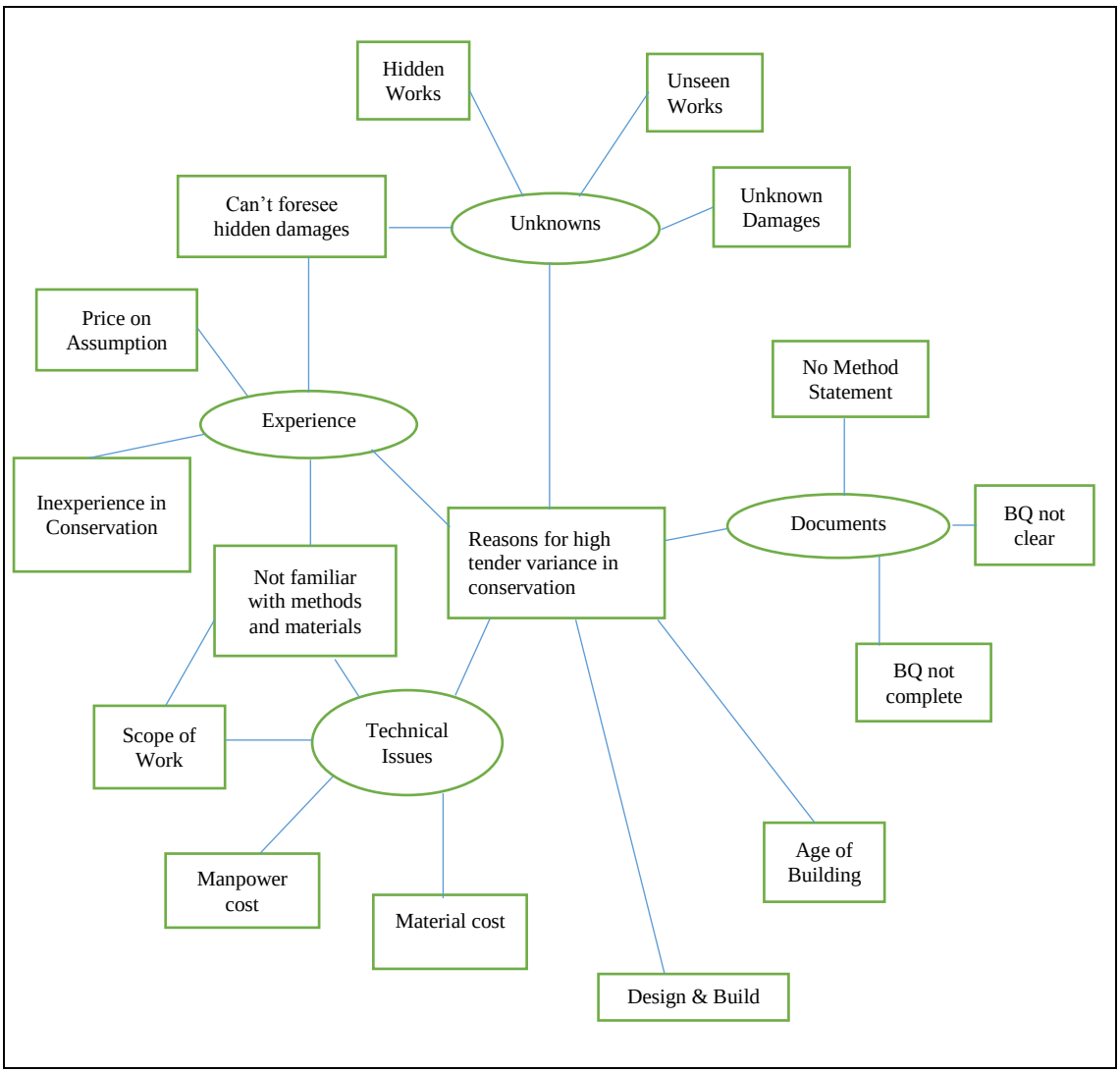

Figure 4.1: Initial thematic map on high variance of tender

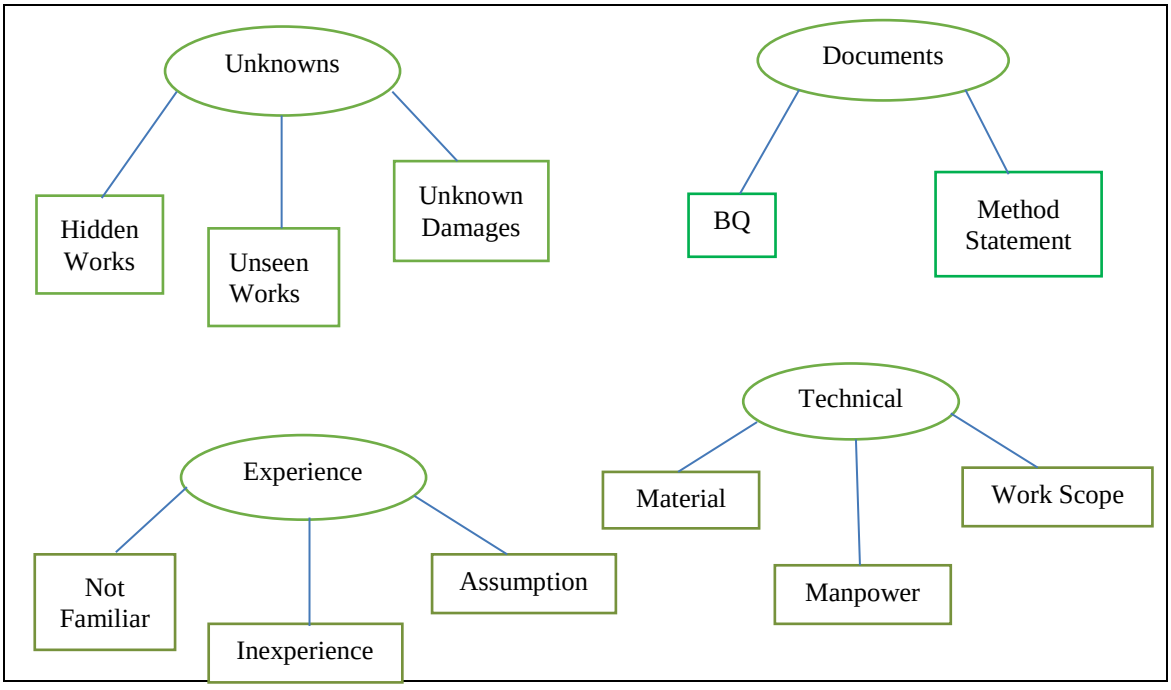

Figure 4.2: Developed thematic map showing 4 main themes

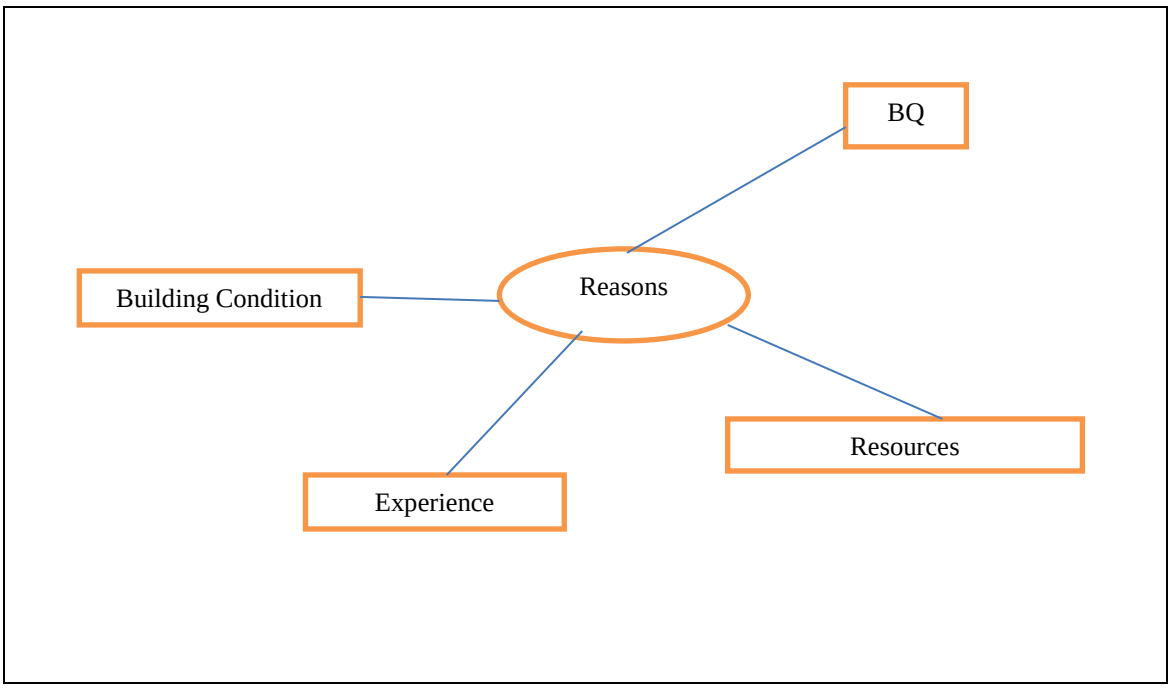

Figure 4.3: Final themes on reasons for high variance of conservation tender

The sequence of the above diagrams showed the development of the themes from the preliminary stage to the final themes. The reasons that were identify for the high variance in the tenders for conservation project covers several aspects namely the building condition, resources, experience and BQ. The existing condition of a heritage building is often mentioned as one of the factors that create difficulty in pricing the tender. This is because much of the works needed to restore or repair the building is largely unknown during tendering stage. Although dilapidation survey is usually done before the tendering stage and a dilapidation report is prepared for reference, many still find that the information in the dilapidation report is not sufficient.

While acknowledging this fact, the interviewees also opined that the briefness of the dilapidation report caused by the difficulty in accessing the various parts of the building to assess its condition. Unless access into all parts of the building is available, this problem is bound to persist. The limitation in access is mainly constrained by safety reasons. Usually the condition of a heritage house that requires restoration is quite

dilapidated with many parts of the house in darkness and with broken and termite infested floorboards as mentioned by one interviewee. Therefore, it is dangerous for the building surveyor to access such areas before proper repairs and reinforcement is done. While recognizing that by solving the access problem, better dilapidation report can be produced but the solution would entails further studies into the process of preparing a dilapidation report which, is outside the scope of this research.

The second reason pertains to resources which are labour and material. The interviewees opined that due to the special construction method, labourers with special skills are needed. These are usually craftsmen as heritage building usually has many decorative elements which are handcrafted. Due to the scarce supply or non-existence of such craftsmen locally, they will have to be brought in from overseas. Usually at the point of tendering, tenderers will not foresee such requirement if it is not being included in the dilapidation report. However, interviewees explained that tenderers that have experience in conservation work may be able to pick up the need for such craftsmen when they attend the site visit session. Those that do will include the price in the tender while those that don't would not have allowed the extra cost of hiring such craftsmen.

Similarly for materials, restoration of heritage building required the original materials or materials from the same time period to be used to replace the damaged part. A common example is where damaged floor tiles will have to be replaced with floor tiles of the same design. In such cases, it would be difficult to purchase such old tiles and the original manufacturer would not be producing it anymore. New manufacturer would not be able to reproduce such tiles or even if it is possible to reproduce the exact type of tiles, the cost would be exorbitant. However, due to the requirement of conservation practice, some project sources such tiles from overseas, e.g. Vietnam

where there are still factory that could produce the old type of tiles. Again this type of information would not be available to the tenderer as the tenderer would not be able to search and source for such tiles in the short tendering period. Therefore, for the purpose of tendering, each tenderer would assume a price for the tiles and this causes the variance as different assumption would yield different price.

In view of the above issues, how then can this problem be alleviated? The interviewees proposed that a standard rate should be included in the tender document as a guide to all tenderers especially for those that are inexperienced in conservation works. With the standard rate available, the difference in pricing would then be due to the mark-up or profit margin allowed by each tenderer. This would allow the tenders to be compared on an "apple to apple" basis. In order to produce such a standard rates, there need to be extensive data collection on unit rates of labour, material and works involved in conservation works. However, work involved in such data collection is extensive and it would be a separate study on its own. As such, establishing the standard rate for different type of craftsmen and the various type of material is also beyond the scope of this research.

The third reason pertains to the experience that is needed to produce a bid amount that is competitive and realistically close to the actual cost. Interviewees explained that experience is needed to enable tenderers to foresee the works required for the project even if the BQ did not state it explicitly. It would seem that experience is related to having knowledge in various areas pertaining to conservation. Tenderers need to know and understand the methods and processes involved in restoration works as well as the skill to assess damages in a building as noted by one interviewee. With such knowledge, they would be able to anticipate the scope of work needed rather

realistically and thus would be able to ensure that all necessary works are priced into the tender.

The “Experience” theme give supports to this understanding as mentioned by Respondent 4 , “Those that have done before, they will know what it takes, those that have never done before, definitely they will price it like a new building.” This indicates that contractor who has prior experience would be able know what are the “hidden works” and thus is able to allow for it in the tender pricing. Interviewees also explain that different level of experience is one of the reasons high variance occurs in conservation tenders especially when coupled with tender documents that are not clear or complete in the description of works needed for the project.

Currently, tenderers obtained such knowledge from hands-on experience but this process is time consuming and limits the opportunity to successful tenderers only. Indirectly, this method discriminates against new contractors as they will always be on the losing side if experience is needed to be able to price realistically. The current situation of having insufficient conservation contractors with experience is also due to the relatively recent interest in restoring heritage buildings. Conservation works only became popular when the twin cities of Georgetown and Melaka received the inscription as the Heritage City from UNESCO in 2008. Without proper and systematic training for contractors in restoration works, the current problem will persists. Therefore, in order to mitigate this problem, there are two suggestions that can be implemented. One is to provide training to interested contractors and the other is to improve the tender document so that contractors do not have to rely on experience to be able to price realistically. In other words, the tender documents should be prepared in a clear and complete manner so that tenderers have all the necessary information and thus

by pricing each item in the BQ would enable the total cost of works to be estimated without missing out any major portion. The training of contractors will not be discussed further as it is outside the scope of this research but the improvement to tender documents specifically the BQ will be further explore in this research.

The fourth reason that emerged from the interview data concerns the bill of quantities or BQ. The issues that are raised by the interviewees touch on the format of the BQ, completeness of information in the BQ and the accuracy of the quantities in the BQ. The "Information" and "BQ" themes actually deal with the lack of availability of information that is needed for pricing. The main purpose of tendering with bill of quantities is to enable the bidding to be conducted where all tenderers are provided with the same information. However, due to the nature of conservation works, information in the bill of quantities may not be complete and this is where the ability of the contractor to manage such unknowns will determine his pricing level. BQ is the foundation for the pricing of the tender and the finding thus far also supports the anecdotal evidence that there is weakness in the BQ that causes problems to the tenderers when they are pricing it.

Although the literature lists much more factors affecting variance in tenders, the interviewees only highlighted the above four. It is not known whether other factors such as overheads and profit and risk allowances do affect the tenders as none of the interviewees mentioned other factors although it was asked during the interview if in their opinion there is any other factor that contributes to the variance in tender amount. It is possible that in the perception of the interviewees whom are mostly small sized contractors, factors such as overheads and risk allowances is not a major pricing issue. Due to the fairly new foray of contractors into conservation works, mostly are willing to

obtain the tender for a small profit to gain experience and thus again profit markup may not list highly in their pricing.

4.4.4 Adequacy of the BQ

The semi-structured interviews also intended to identify the adequacy of the BQ in terms of format and sufficiency of information for the purpose of pricing. Similar to the analysis conducted for the causes of high variance, all responses from the semi-structured interviews are coded to find the emerging theme pertaining to the adequacy of the BQ. The preliminary and final coding is shown in Table 4.20.

Table 4.20: Themes on adequacy of the BQ

No	Preliminary Coding	Final Coding
1	No standard BQ format Incomplete BQ Missing work item Incomplete description Confusing arrangement of BQ Combined BQ M&E Works Preliminaries Testing Profit and Attendance Prime Cost Sum Provisional Sum External Works Description style Pricing actual damage	BQ related inadequacies
2	Specification not complete Specification not specific to conservation works No standard specification Weak specification	Specification related inadequacies

Table 4.20: Themes on adequacy of the BQ (continued)

No	Preliminary Coding	Final Coding
3	No method statement HABS format not given No research study(initial study) Guidelines Schedule of rates Dilapidation report Overseas material Design & Build	Other inadequacies

Themes that emerged from the interviews are "BQ related inadequacies", "Specification related inadequacies", "Other inadequacies" and "No effect on pricing". The theme "BQ related adequacies" highlights the weaknesses in the BQ of conservation projects currently faced by tenderers. The BQ seems to be rather incomplete in terms of the items of work as well as the description for the items of work. As the total tender sum is derived from the sum of all items of work in the BQ, missing items will surely affect the tender amount.

The second theme on "Specification related adequacies" points to the insufficient and generic specifications used in conservation project tenders. Without adequate and clear specifications, the estimator will have difficulty in pricing because specifications provide information to assist the estimator in pricing the work that is needed to be carried out (Ashworth & Hogg, 2007).

The "Other inadequacies" is a non BQ related deficiency but emerged as a weakness in the tender documentations of conservation works. The interviewees highlighted that tenders without method statements means that each tenderer will price according to his

own method of construction and this will bring about a big variance especially if some follow strictly to the conservation guidelines while others don't.

As both specifications and method statement relates to how items of work are to be carried out and in the case of specifications, it also indicates the quality and performance required from the works, both are important information for the estimator to calculate the price.

4.4.4.1 Sub-themes for BQ Related Inadequacies

Under the theme "BQ related inadequacies", sub-themes are identified to delve deeper into the issue. The sub-themes are presented in Table 4.21 below.

Table 4.21: Sub-themes for BQ related inadequacies

No	Sub-themes
1	Detail and bespoke preliminaries
2	More details in BQ
3	Damage treatment items in PC Sum
4	Reduce provisional sum items

It can be seen from Table 4.21, four sub-themes emerged from the interviews. Sub-theme on "detail and bespoke preliminaries' pertains to the issues on the preliminaries section. Feedback from the interviewees state that preliminaries contain too much items which are not relevant to the project thus making the section thick and difficult to read. The respondent R8 mentioned that "*preliminaries kena buat special, specific untuk kerja conservation*" which means that the preliminaries should be specific to the works related to conservation. This response is also supported by respondent R7, "preliminaries have to be more detail for heritage works". Items that are specific to conservation should be included and clauses should also be written in detail so that the tenderers are sure of the scope of works. Respondent R6 explains it in this way,

"preliminaries should be more detail, if not it will be difficult to compare because you do not know what is included in the price". For items that have a fixed rate, the respondent R9 suggest that the rate should be included in the preliminaries to facilitate the pricing by tenderers, "*bagi satu kadar harga untuk a few items yang memang dah tahu harganya fix* (provide a rate for a few items that is known to have fixed rate)".

Sub-theme of "more details in BQ" emerged as the interviewees suggested that details are inadequate in the BQ. Respondents R2 mentioned, "increase detail in BQ" while R3 states that to have, "BQ as detail as we can". A BQ with good detail description would be fair to everyone as the estimator could price accurately according to the scope of work needed. Respondent R4 opined that, "the more they put in is fair to everyone".

The last two sub-themes deal with the Prime Cost and Provisional Sum section. Treatment to damages such as salt attack, rising damp and termites is suggested to be included in the p.c. sum section instead of in the preliminaries section as practiced currently. This is suggested by respondent R7, "salt desalination and rising damp put in as PC Sum" and also respondent R9, "salt desalination, rising damp, termite *masuk dalam* PC Sum (salt desalination, rising damp, termite include in PC Sum)".While the interviews reveal that PC sum items should increase, provisional sum items should be reduce as suggested by respondent R3, "no need so much provisional sum". Respondent R6 advised that provisional sum to be allocated for unseen works.

4.4.4.2 Sub-themes for "Specification Related Inadequacies"

While there is not much feedback from interviewees regarding specifications, the suggestion is to improve the existing specifications. Currently, specifications are found

to be lacking and inadequate by the interviewees as mentioned by respondent R8, "*ada banyak lagi spesifikasi yang kita boleh buat. Kena sit down dengan conservator untuk mendapatkan spesifikasi yang lebih bagus* (there are many more specifications that we can produce. Have to sit down with the conservator to obtain a better specification).

4.4.4.3 Sub-themes for "Other Inadequacies"

Other inadequacies refer to issues the interviewees faced pertaining to other documents that is relevant or needed in the tender exercise but is not the BQ per se. The documents referred to are HABS, Schedule of Rate, Dilapidation Report, Method Statement and Historical Research Report. The interviews found that the required format for HABS was not given in the tender, thus contributed to the big variance in the pricing of the HABS which can range from RM5,000.00 to RM50,000.00 as indicated by respondent R4. This is because without any clear information on the format required, different tenderers will price based on different assumption and this is where the big price difference lies. Again, the interviewee (R4) also mentioned that providing a schedule of rate would assist tenderers in producing a more competitive bid because some are not familiar with the rates and thus without any guide, they may either price too high or too low. Issues with dilapidation reports pertain to the briefness of the report which does not provide adequate information for the tenderers such as the method of repair that is recommended. Therefore, it is difficult for the estimator to know the actual scope of work and to price accurately. One of the interviewee, R7 also stress that it is important for the dilapidation report to be completed before tendering so that quantity surveyor can use the information in the dilapidation report to prepare the BQ.

Although the common practice in construction industry is for the tenderer to provide the method statement for the project, some of the interviewees are of the opinion that there should be some standard method statement included in the BQ as a guide for the tenderers. Respondent R1 states that, "if no method of statement, it is difficult to price because it determines the labourers and materials used and the methods". The feedback from Respondent R6 also concurs with the statement from R1, "method statement will definitely help in the pricing. That is why you can see a lot of price variation between tenderers when you don't have method statement". This is due to the methods that are available for restoration as well as the conservation approach that is taken by different conservator may vary. Respondent R10 suggested that standard method statement should be compiled and included in the BQ, "*saya perhatikan ada kebaikannya apabila agensi mengumpul segala method of statement yang diberi oleh kontraktor dan diolah semula* (I observed that there is benefit when agency collect and compile all method statement submitted by contractors to be improved)".

While the above documents are fairly common for construction projects, the suggestion for historical research report is only specific to conservation projects. From the semi-structured interviews, one of the interviewees explained that historical research is needed to record the historical significant of the heritage building which may then influence the approach and method of conservation to be adopted. Usually such report must be produced before tender commencement similar to dilapidation report. However, if the historical study in not done, then it should be included in the tender document to enable the cost to be captured as part of the project cost.

4.4.5 Adequacy of BQ Format

The following Figure 4.4 and 4.5 show the development of the themes from the preliminary stage to the final themes. In the final stage (Figure 4.5), the themes points to adequacy in terms of BQ, Specification related and Other documents. Other documents are documents that are not part of BQ or Specifications.

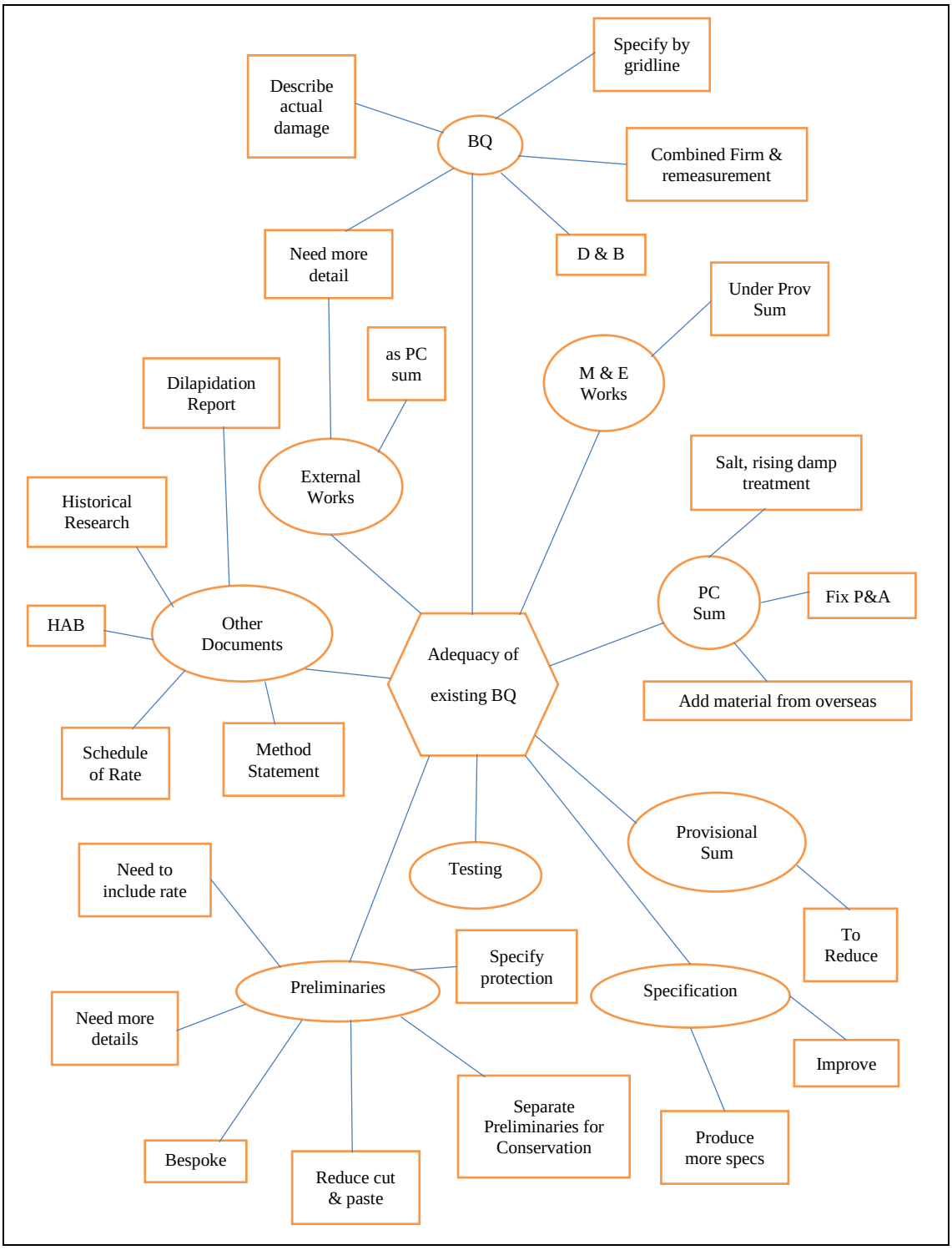

Figure 4.4: Initial thematic map on adequacy of existing BQ

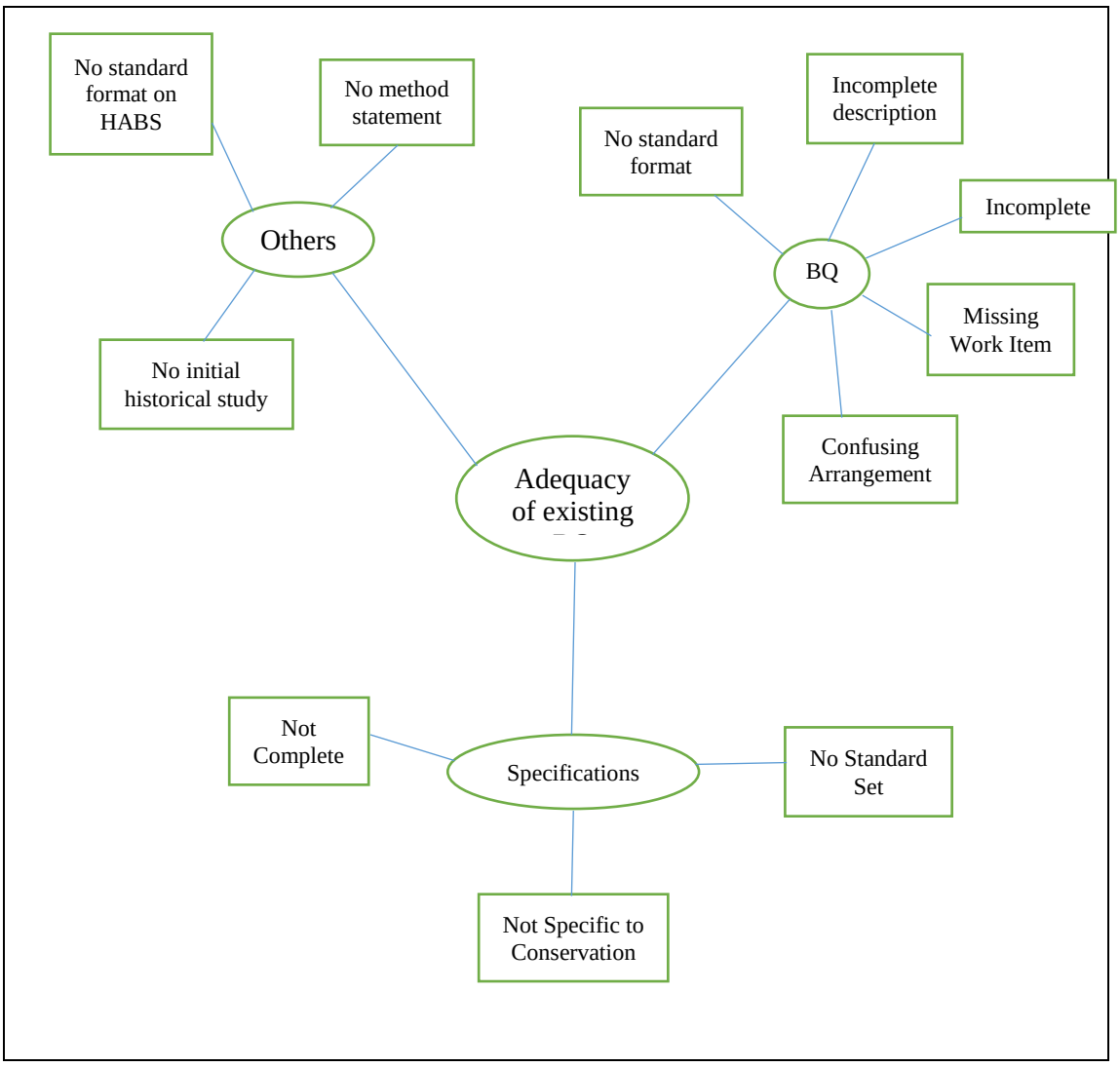

Figure 4.5: Final themes for adequacy of existing conservation tender

Adequacy means being sufficient for the purpose it is meant for. Adequacy in this research pertains to usefulness of the BQ for pricing purposes. In other words, is the format of the BQ useful or helpful to the tenderers for their pricing purpose? Format of BQ pertains to description, unit and sequence of the items of work. The in-depth interviews reveal flaws in the BQ format which causes tenderers to mark-up their price to compensate for the possibility that they may under-price due to incomplete information.

Respondent R1: “the pricing we have to put more to cover because sometimes they cannot give the variation order (to cover the missing items)”.

In what ways is the format of BQ inadequate to help the tenderers to price? The findings indicate several problems with the BQ which are “BQ lack of details”, “no standard BQ format”, “incomplete description”, “description not clear”, “confusing arrangement of BQ”, “missing work items” and “BQ not accurate”.

The interviewees point out that the BQ did not describe the items of work in detail. Interviewee R2 and R3 further explained that the descriptions are not complete and clearly written. The common practice is to use an all-encompassing description in the hope that whatever necessary works are covered. However, this method will inflate the price as the tenderer does not really know the actual scope of work and price for everything even those that may not be needed. On the other hand, some will describe very briefly and refer to drawings or specification for additional information. This type of description is also not suitable as it invites different assumptions from different tenderers on the scope of work. In addition to incomplete description, the interviewees also pointed out that the BQ has missing items of work. As such the tender amount would be inadvertently be under-priced due to the cost of some items that have been left out. However, tenderers with experience may allow in the BQ for items that are not included in the BQ if they anticipate that the works are needed. When this happens, the price difference between tenderers will be high.

4.4.6 Adequacy of Information

In addition to the adequacy of BQ format, this research also investigates the completeness of information available in the BQ for pricing. The findings from the interviews reveal that several types of information are lacking, namely, the BQ, method

statement and specification. As discussed in 4.4.2.3, one of the BQ flaw is the weak description. Other than incomplete information in the BQ, interviewees also mentioned that information such as method statement and specifications are not included or insufficient. The common practice is for the tenderer to submit their proposed method statement for the Architect to approve. This practice again causes pricing differences as different tenderers will proposed different methods and will priced their tender according to their own proposal. Similarly for conservation works specifications, there is no industry approved standard specifications like for new build. As such, many QS preparing tender documents will use the standard specifications for new build as the main specifications with addition of piece meal specifications for works related to conservation.

4.4.7 Suggestions for Conservation Specific BQ

During the last part of the interviews, interviewees are asked to give their opinions and suggestions to improve the current conservation BQ so that the proposed BQ would be suitable for conservation works tender. Again the data collected from this part of the interviews are analysed using thematic analysis. The theme or category of suggestions is derived from the transcripts of the interviews. Each suggestions are examined to determine its use in building the proposed guidelines for a conservation specific BQ. The data and analyses will be discussed according to the sections of the BQ.

4.4.7.1 Preliminaries

Conventionally, this forms the first part of the BQ. According to the SMM2, the preliminaries sections are for inclusion of works which do not form part of the construction works but are required in the construction process. The interviewees were asked to provide suggestions for the improvement of Preliminaries in terms of the items

of work, the format and the sufficiency of information provided. The interviews did not touch on items of works that are general to all types of construction works but limit the questions only to conservation specific items. The extract from the interview sessions are categorized according to the suggestions that emerged from the interviews and all categories are shown in Table 4.22. The suggestions are used to design the questionnaire for the Delphi Survey.

Table 4.22: Data extract for improvement to Preliminaries

Category	Data extracted from transcripts of 10 interviews
No changes needed	*Preliminaries sudah kira detil* (Preliminaries are considered detailed)(R9) Preliminaries no need changes (R2)
Need to add details	Has to be more detail. Not a standard preliminaries (R7). Preliminaries should be more detail (R6) More details and reduce copy and paste items (R3)
Conservation specific items	Has to consider addition requirement i.e. traffic management working space. Add items specific to conservation. (R7) Add clause on archaeology findings (R8) Temporary structs should be in the preliminaries (R7) Material testing should be in preliminaries. State acceptable range and where to test (R6) Should have comparison test between new and existing plaster (R6) Specify protection method (R8) *Bagi satu cadangan untuk protection of interior* (give suggestions on how to protect the interiors)(R8) Add in items specially for conservation works (R5)
	Item preliminaries yang lain daripada test pit boleh jadikan compulsory (Preliminaries items other than test pit can be made as compulsory item) (R9) *Preliminaries kena buat spesial, spesifik* (Preliminaries must be special, specific (to conservation))(R8) Other preliminaries items ok but protection of interior depends on project (R7)

Based on feedback from the semi-structured interviews, the following suggestions as shown in Table 4.23 are put forth and these suggestions are validated through 2 rounds of Delphi survey which is discussed in the next chapter.

Table 4.23: Suggestions for improvement to Preliminaries

No.	Items
1	There should be a standard template for Preliminaries which consists of two sections.
1(a)	The first section covering general items such as contract, general facilities, mobilisation, insurance, water, access, etc. This section to be named General Preliminaries.
1(b)	The second section covering work specific to conservation such as HABS, Hammer Schmidt test, conservator, temporary roof, etc. This section to be named Conservation Related Preliminaries.
2	Description for Preliminaries must be detailed. Information should include (where applicable) a. Sizes, b. Material, c. Composition and mix, d. Method of application/fixing, e. Source of material/labour, f. Approved test laboratory, g. Treatment methods, h. Quantity required. (Adapted from SMM2 & interviews) *E.g. Protection to existing interior floor with one layer of P.E. sheet 0.25mm thick as base, 2.4mm thick plywood laid on base layer and cement sand screed 15mm thick laid on plywood.* *Obtain 1 sample each of plaster from dining room wall marked A, B and C on drawing A123 and send to approved lab listed in Appendix X for testing of plaster mix and composition*
3	A standard rate should be included in the tender for specialist items such as conservator and HABS to avoid high variance between tenders. *E.g. Provision for conservator during the entire duration of project of 15 months at a salary of RM5,000/month.*

In addition to the general rules for Preliminaries, conservation specific items mentioned by the interviewees are included in the Delphi Survey to seek the expert's opinion on its inclusion in the Preliminaries or Main Works section. This is shown in Table 4.24.

Table 4.24: Suggestions for conservation specific Preliminaries items

No.	Items	Preliminaries	Main Works
1	Provision of measured drawings before and after conservation works.		
2	Provision of Dilapidation Report.		
3	Provision of archaeological test pit of 1m x 1m		
4	Provision for conservationist (or other related specialists) on site.		
5	Provision for protection of interior, railing, framing and furniture.		
6	Provision for protection of exterior façade.		
7	Provision for temporary roof covering.		
8	Provision for each type of lab tests required.		
9	Specify frequency of progress report needed (weekly), no. of copies needed and the format required.		
10	Provision for technical visit to local and overseas site/factory if needed.		
11	Provision for temporary struts/support structure.		
12	Provision for mock-up of lime plaster, painting and any other finishes that is needed.		
13	Provision for clearing of debris/vegetation before commencement of work.		
14	Provision for education/awareness exercise by installing information board and window for public to learn about the conservation process.		
15	Provision for HABS1, HABS2 and HABS3		
16	Provision for clause to manage archaeological find.		
17	Provision of video recordings of existing building conditions and the conservation process.		

4.4.7.2 Measured Works

The data extracted from the interviews pertaining to measured works are tabulated in Table 4.25 and suggestions from the interviewees for the measured works section are tabulated in Table 4.26. The suggestions are proposals on bill sections, the type of bill, the sequence of bill as well as the format of description. The comments/suggestions given by the interviewees are used to formulate the guidelines which are verified by experts in the Delphi survey.

Table 4.25: Data extract for improvement to measured works

Category	Data extracted from transcripts of 10 interviews
Type of BQ	Remeasurement Bill (R10) Firm Bill (R1, R2, R6, R9) Firm and remeasure depends on items (R8) BQ is better than lump sum (R4) Combined firm and remeasure (R3) Mostly no remeasurement (R7)
Sequence of BQ	Sequencing of BQ is important (R9)
Description	No "or equivalent" (R9) Need to know actual damage and how to repair it (R8) Some description is not clear (R6) Should describe by gridline (R6) Must ascertain on site for more details (R5) More detail is fairer (R4) As detail as possible (R3)
Measurement	More details, door and window cannot by number (R9)
Items in BQ	Add protection in BQ (R3) Protection in BQ (R2) BQ to be more detail (R2) Temp roof cover in BQ (R2)

Table 4.26 below lists the proposals for measured works to be included in the Delphi survey questionnaire.

Table 4.26: Suggestions for improvement to measured works

No.	Items
1	There should be a standard template for Measured works bill which consists of three sections namely Demolition, Conservation Works and New Works.
2	Items in the Demolition and New Works sections will remain status quo in accordance with the Standard of Measurement for Building Works 2nd Edition (SMM2) requirements.
3	Items in the Conservation Works section should follow conservation works sequence which is top-down, i.e. starting with roof instead of work below ground.
4	Description of items of work should include (where applicable) a. Sizes, b. Material, c. Composition and mix, d. Method of application/fixing, e. Source of material/labour, f. Treatment methods, g. Quantity required. h. Supplier of special/original material i. List of specialists j. Type of testing k. Number of testing needed l. Location of test samples to be taken m. Approved testing laboratory n. Reference for special works (Adapted from SMM2 and interviews)
5	Related and/or similar works should be grouped together. *E.g. protection to railing to be included together with repair works to staircase INSTEAD of putting protection in Preliminaries Bill and repair works to staircase in Measured Works Bill.* *Testing for plastering to be put together with plastering work to wall INSTEAD of separating testing in Preliminaries Bill and plastering in Measured Works Bill.*
6	Do not use "or equivalent" in the description.
7	Do not use vague and all-encompassing description. Be specific. *E.g. Replace damage window frame with new frame and make good. [**vague**]* *Cut carefully damaged part of window frame marked X in drawing A and replace with similar frame sourced from list of supplier in Appendix X. Method of cutting and fixing to follow Method Statement 123.[**specific**]*
8	Description should include gridline reference for each item of work.
9	Quantities must be firm quantity (NOT PROVISIONAL)
10	Bill should be firm bill with quantities NOT provisional bill.

4.4.7.3 P.C. and Provisional Sum

The interviewees also provided comments on the P.C. and Provisional Sum section which are tabulated in Table 4.27.

Table 4.27: Data extract for improvement to P.C. and Provisional Sum

Data extracted from transcripts of 10 interviews
P.C. and Provisional Sum to add specialist work (R9)
Salt desalination and rising damp put in pc sum (R7)
Have items for unforeseen work (R6)
Reduce P.C. and Provisional Sum (R3)
Ordering of materials from overseas to include in P.C. Sum (R2)
Prefer no P.C. and Provisional Sum (R2)
External works to convert to PC Sum (R1)
Salt removal, rising damp, termite (R9)
Rising damp- put in rate/m2 then later determine the area (R7)

Similar to the above section, the feedback from the semi-structured interviews are also used in formulating the suggestions to improve the P.C. and Provisional Sum for conservation tenders. Table 4.28 lists the suggestions which are also included in the Delphi survey.

Table 4.28: Suggestions for improvement to P.C. and Provisional Sum

No.	Items
1	External Works should be given as P.C. Sum because works usually start one year later and calling tender nearer to the start date will ensure the cost is reflective of current market price.
2	Purchase of material from overseas should be included in P.C. Sum due to the uncertainty during tendering period.
3	Salt desalination treatment should be given as P.C. Sum because extent of salt attacks difficult to determine during tendering period.
4	Rising damp treatment should be given as P.C. Sum because extent of rising damp difficult to determine during tendering period.
5	Termite treatment should be given as P.C. Sum because extent of damage difficult to determine during tendering.
6	Technical visit to view similar restoration or material manufacturers should be given as P.C. Sum.
7	M & E Works should be given as P.C. Sum.

4.4.7.4 Documents Other than BQ

As mentioned earlier, the semi-structured interviews also unearthed the need for documents other than BQ to be included in a conservation tender. As such, although these documents are not BQ per se but it is still part of the tender and thus it will be included in this research but not as in-depth as the BQ document. Similarly, data extracted from the semi-structured interviews are listed in Table 4.29 below.

Table 4.29: Data extract for improvement to documents other than BQ

Category	Data extracted from transcripts of 10 interviews
Schedule of Rates	Provide schedule of rate for negotiation of price (R4) *Bagi satu kadar harga supaya kontraktor tak underpricing* (provide schedule of rates so that contractor will not underprice) (R9) Schedule of rate as a guide to the contractor (R10)
Method Statement	Need a general method statement (R7) Method statement not inside the BQ (R8) The method statement should include method to repair damages (R8) Should have a compilation of method statement as standard document (R10)
Dilapidation Report	Dilapidation report should be done before tender (R7) Need detail dilapidation report (R9) Dilapidation report should describe more (R9) Detail dilapidation report will help contractor understanding of the works required (R10)
HABS	Need to provide the format of HABS (R3)
Historical Study	Need to add research on historical study (R10)

The suggestions derived from the above data are summarized in Table 4.30 below and are to be incorporated into the questionnaire for the Delphi Survey.

Table 4.30: Suggestions for improvement to documents other than BQ

No.	Items
1	A Schedule of rates duly filled with a range of unit rates should be included in the tender document as a guide for tenderers due to unfamiliarity with conservation works.
2	The existing method statements in the industry should be compiled to form a standard reference document.
3	A new section should be created to incorporated method statement in the tender document.
4	Dilapidation report should be included in the tender document.
5	Dilapidation report should identify all damages in detail, marked the damages in the drawings and describe the accepted methods to repair the damages.
6	Definition of HABS must be given clearly to reduce individual interpretation of HABS.
7	Instructions on proper methods to prepare HABS and HABS reports should be included in the tender document.
8	Historical study should be conducted and a report produced for reference.

These feedbacks from the semi-structured interviews form the basis for the first questionnaire in the Delphi survey.

4.5 Summary

This chapter discusses about the data that is collected and the results from the analysis conducted. Data from the document study are analysed using coefficient of variation to determine the variance level of tenders in conservation projects. The findings identified that variance for tender of conservation works is higher than new build works which corroborated anecdotal evidence on the same issue. Next, the reasons for the high variance are found to be hidden works, inexperience, bill of quantities and labour and material costs. The same data are also used to determine the adequacy of existing BQ and three major themes are found namely, BQ related inadequacies, specifications related inadequacies and other documents inadequacies. The development of questionnaire for Delphi survey is also discussed here. The findings from the Delphi will be discussed in Chapter 5.

CHAPTER 5: VALIDATING THE FINDINGS

5.1 Introduction

This chapter presents the data validation process for the proposed guideline that was derived from the semi-structured interviews. The research process conducted in this stage is to achieve the third objective which is to determine a suitable format and structure of information for bills of quantities that can adequately described the works items in a building conservation project to enable accurate cost estimating during tendering stage. The validation process is conducted using Delphi survey method. This method is commonly used in forecasting and as it is not possible to test the proposed guidelines immediately in a real life project, the research has to rely on the Delphi survey method to validate the suitability of the proposed guidelines for preparation of building conservation BQ.

This chapter will commence with the feedback of both rounds of the Delphi survey and proceed to the proposed guidelines for the preparation of BQ for building conservation tender.

5.2 Delphi Survey

The semi-structured interviews yielded information on the problems faced during tendering as well as suggestions for improvement. Based on the findings from the interviews, a guideline for improvement is proposed and the feedback on the suitability of the proposed guideline is obtained from the Delphi survey method. A 2-round Delphi survey method is used and the data from both rounds of survey is presented below.

5.2.1 Respondent Profile

The Delphi survey uses a panel of experts instead of random respondents to provide feedback to the questionnaire. For this research, the panellists are selected from quantity surveyors and architects that have experience in conservation projects. Professional quantity surveyors and architects from the private and public sectors are chosen to ensure that there is a good mix of experts from both sectors to provide a balance viewpoint on the questions asked. As there are no official list or registration for professionals in building conservation, the list of experts are compiled based on recommendations from the industry and also from the relevant authorities in charge of conservation projects. The panellists are asked if they are willing to participate in the 2-rounds Delphi survey and all agreed. The list consists of 7 professionals from the private sector and 5 from the public sector. Although the 7 professionals are from the private sector but they are also involved in consultancy work for the public sector. Although some panellists have only 1 to 3 years of experience, nevertheless they are familiar with the policies and requirement of public sectors in conservation projects tendering. Table 5.1 list the panel of experts, their affiliation and years of experience in handling conservation projects.

Table 5.1: List of panel of experts in the delphi survey

No	Panellist Code	Profession	Affiliation	Experience in conservation projects
1	P1	Quantity Surveyor	Private Consultant Firm	15 years
2	P2	Quantity Surveyor	Private Consultant Firm	13 years
3	P3	Quantity Surveyor	Private Consultant Firm	7 years
4	P4	Quantity Surveyor	Private Consultant Firm	3 years
5	P5	Quantity Surveyor	Public Works Department	4 years
6	P6	Quantity Surveyor	National Heritage Department	1 year
7	P7	Quantity Surveyor	Local Authority	3 years
8	P8	Conservation Architect	Private Consultant Firm	20 years
9	P9	Conservation Architect	Private Consultant Firm	20 years
10	P10	Conservation Architect	Private Consultant Firm	16 years
11	P11	Conservation Architect	Academician	20 years
12	P12	Architect	Public Works Department	1.5 years

5.2.2 Results from Round 1 of Delphi Survey

Upon the return of questionnaires in Round 1, the answers are tabulated and analysed in preparation for Round 2 of the survey. The answers are analysed using the measures of central tendency to determine which proposals received consensus from the panellists. The mode of the data is converted into percentage for ease of reference.

5.2.2.1 Preliminaries

Table 5.2 shows the tabulated results of Round 1 for questions on Preliminaries Bill. Five proposals for the format of Preliminaries Bill is included in the questionnaire to the panel of experts and out of five questions, four proposals received consensus percentage and only one proposal on the format of description did not receive a clear consensus from the experts. The proposals that received consensus are listed below.

1. A standard template for Preliminaries which consists of two sections.
2. The first section of Preliminaries covering general items such as contract, general facilities, mobilisation, insurance, water, access, etc. This section to be named General Preliminaries.

3. The second section of Preliminaries covering work specific to conservation such as HABS, Hammer Schmidt test, conservator, temporary roof, etc. This section to be named Conservation Related Preliminaries.
4. A standard rate should be included in the tender for specialist items such as conservator and HABS to avoid high variance between tenders.

   E.g. Provision for conservator during the entire duration of project of 15 months at a salary of RM5,000/month.

The proposal that did not receive consensus pertains to proposal 3 which suggests that description for Preliminaries must be written in detail as per the information shown on the questionnaire. While one panellist commented that the detailed description should be for Category 1 heritage building only (P9), some of the panellists do not agree to such details commenting that, "Preliminaries to be kept simple. Those details to be put in BQ/work description. Generally, conservation work is small size and detailed preliminaries will give rise to higher preliminaries cost" (P11). Another panellist states that such information is not normally in the preliminaries (P6) and one suggests to "park it under specification" (P8). An interesting finding from this survey is that panellists with disagreeing comments are mostly conservation architects as compared with quantity surveyors. This question is included again in Round 2 with the addition of comments for the panellists to consider and provide their feedback again. In addition, a new question asking the panellists "should the Preliminaries description should be simple?" is included.

Table 5.2: Results for Preliminaries bill – round 1

No.	Items	Agree	Disagree	Comments
1	There should be a standard template for Preliminaries which consists of two sections.	90 % (9/10)	10% 1/10)	
1(a)	The first section covering general items such as contract, general facilities, mobilisation, insurance, water, access, etc. This section to be named General Preliminaries.	91% (10/11)	9% (1/11)	
1(b)	The second section covering work specific to conservation such as HABS, Hammer Schmidt test, conservator, temporary roof, etc. This section to be named Conservation Related Preliminaries.	100% (11/11)	0% (0/11)	
2	A standard rate should be included in the tender for specialist items such as conservator and HABS to avoid high variance between tenders. *E.g. Provision for conservator during the entire duration of project of 15 months at a salary of RM5,000/month.*	75% (9/12)	25% (3/12)	
3	Description for Preliminaries must be detailed **as per example below**. Information should include (where applicable) i. Sizes, j. Material, k. Composition and mix, l. Method of application/fixing, m. Source of material/labour, n. Approved test laboratory, o. Treatment methods, p. Quantity required. (Adapted from SMM2 & interviews) E.g. Execute the installation of datum point and datum line for the purpose of setting up grids. Gridlines should be demarcated using nylon strings measuring 1.00 x 1.00 meter to the surface of wall, floor and ceiling. Scaled photographs should be taken based on the fixed grids at all parts of the buildings before commencement of conservation works, during and upon completion of the works.	58% (7/12)	42% (5/12)	*This information is not normally in the Preliminaries but is measured in the Main Works Bill. (P6)* *However, can be park under Specification.(P8)* *Apply to category 1 building.(P9)* *Preliminaries to be kept simple. Those details to be put in BQ/work description. Generally conservation is small size and detailed preliminaries will give rise to higher preliminaries cost.(P11)*

Table 5.2 shows the results of Round 1 regarding where the special conservation related items as listed should be located, whether it should be in the Preliminaries bill or Main Works bill. Items 1 to 9 received consensus while items 10 to 17 received differing opinions from the experts. Items 1 to 9 that have received consensus to be included in the Preliminaries bill are listed below.

1. Provision of measured drawings before and after conservation works
2. Provision of Dilapidation Report
3. Provision for conservationist (or other related specialists) on site
4. Provision for temporary roof covering
5. Specify frequency of progress report needed (weekly), no. of copies needed and the format required
6. Provision for technical visit to local and overseas site/factory if needed
7. Provision for education/awareness exercise by installing information board and window for public to learn about the conservation process
8. Provision for HABS1, HABS2 and HABS3
9. Provision for clause to manage archaeological find

The above items will be included in the guideline accordingly. While items 10-17 will be repeated in Round 2 of the survey.

Table 5.2: Results for Preliminaries bill – round 1(continued)

No.	Items	Preliminaries	Main Works
1	Provision of measured drawings before and after conservation works.	80% (8/10)	20% (2/10)
2	Provision of Dilapidation Report.	70% (7/10)	30% (3/10)
3	Provision for conservationist (or other related specialists) on site.	75% (9/12)	25% (3/12)
4	Provision for temporary roof covering.	67% (8/12)	33% (4/12)
5	Specify frequency of progress report needed (weekly), no. of copies needed and the format required.	77% (10/13)	23% (3/13)

Table 5.2: Results for Preliminaries bill – round 1(continued)

No.	Items	Preliminaries	Main Works
6	Provision for technical visit to local and overseas site/factory if needed.	73% (8/11)	27% (3/11)
7	Provision for education/awareness exercise by installing information board and window for public to learn about the conservation process.	78% (7/9)	22% (2/9)
8	Provision for HABS1, HABS2 and HABS3	73% (8/11)	27% (3/11)
9	Provision for clause to manage archaeological find.	73% (8/11)	27% (3/11)
10	Provision of archaeological test pit of 1m x 1m	45% (5/11)	55% (6/11)
11	Provision for protection of interior, railing, framing and furniture.	50% (6/12)	50% (6/12)
12	Provision for protection of exterior façade.	54% (7/13)	46% (6/13)
13	Provision for each type of lab tests required.	50% (6/12)	50% (6/12)
14	Provision for temporary struts/support structure.	58% (7/12)	42% (5/12)
15	Provision for mock-up of lime plaster, painting and any other finishes that is needed.	50% (6/12)	50% (6/12)
16	Provision for clearing of debris/vegetation before commencement of work.	33% (4/12)	64% (8/12)
17	Provision of video recordings of existing building conditions and the conservation process.	64% (7/11)	36% (4/11)

5.2.2.2 Measured Works

Table 5.3 shows the results of Round 1 for questions on Measured Works bill. In this round, proposals 1 -5 received consensus while proposals 6 – 10 did not achieve the consensus percentage. The proposals that received consensus in Round 1 are listed below.

1. A standard template for Measured works bill which consists of three sections namely Demolition, Conservation Works and New Works.
2. Items in the Demolition and New Works sections will remain status quo in accordance with the Standard of Measurement (SMM2) requirements.
3. Description format for items of work. Related and/or similar works should be grouped together. E.g. protection to railing to be included together with repair

works to staircase INSTEAD of putting protection in Preliminaries Bill and repair works to staircase in Measured Works Bill.

4. Description must be specific. Do not use vague and all-encompassing description.

The following 5 proposals as listed below did not receive the required consensus and will be included again in Round 2.

1. Items in the Conservation Works section should follow conservation works sequence which is top-down, i.e. starting with roof instead of work below ground.
2. Do not use "or equivalent" in the description.
3. Description should include gridline reference for each item of work.
4. Quantities must be firm quantity (NOT PROVISIONAL)
5. Bill should be firm bill with quantities NOT provisional bill.

The comments given by the panellists are shown in Table 5.3 and are included in the Round 2 questionnaire for the panellists' consideration and decision. For proposal 1 as above, panellist P11 and P12 disagree with the proposal and commented that other works can also commenced first while panellist P6 suggested using elemental format. For this item, 62% is in agreement, almost reaching the stipulated consensus but in complying strictly with the stated research consensus percentage, this proposal will be included again in Round 2 to obtain a firm consensus. For the proposal on the use of "or equivalent", panellist P8 agreed with the proposal but state that in order not to use "or equivalent", the Architect must confirm the material at the early stage. The comments received on the proposal regarding the use of gridline reference is equally divided with some in agreement (P3, P4, P11) but others feel that it is not practical (P6,

P9, and P10). Please refer to Table 5.3 for the comments in detail. For the proposal for firm quantities, although there is no clear consensus but more panellists tend to disagree with quantities being firm giving the reason that quantity cannot be determined until work is open up (P6). The same rationale is also given by the panellists for the proposal on having firm bill of quantities instead of a provisional bill.

Table 5.3: Results for measured works bill – round 1

No.	Items	Agree	Disagree	Comments
1	There should be a standard template for Measured works bill which consists of three sections namely Demolition, Conservation Works and New Works.	100% (12/12)	0% (0/12)	
2	Items in the Demolition and New Works sections will remain status quo in accordance with the Standard of Measurement (SMM2) requirements.	91% (10/11)	9% (1/11)	
3	Description of items of work should include (where applicable). o. Sizes, p. Material, q. Composition and mix, r. Method of application/fixing, s. Source of material/labour, t. Treatment methods, u. Quantity required. v. Supplier of special/original material w. List of specialists x. Type of testing y. Number of testing needed z. Location of test samples to be taken aa. Approved testing laboratory bb. Reference for special works (Adapted from SMM2 and interviews)	78% (11/14)	22% (3/14)	
4	Related and/or similar works should be grouped together. *E.g. protection to railing to be included together with repair works to staircase INSTEAD of putting protection in Preliminaries Bill and repair works to staircase in Measured Works Bill. Testing for plastering to be put together with plastering work to wall INSTEAD of separating testing in Preliminaries Bill and plastering in Measured Works Bill.*	77% (10/13)	33% (3/13)	
5	Do not use vague and all-encompassing description. Be specific. *E.g. Replace damage window frame with new frame and make good. [**vague**]* *Cut carefully damaged part of window frame marked X in drawing A and replace with similar frame sourced from list of supplier in Appendix X. Method of cutting and fixing to follow Method Statement 123.[**specific**]*	82% (9/11)	18% (2/11)	

Table 5.3: Results for measured works bill – round 1 (continued)

No.	Items	Agree	Disagree	Comments
6	Items in the Conservation Works section should follow conservation works sequence which is top-down, i.e. starting with roof instead of work below ground.	62% (8/13)	38% (5/13)	*This section can also be measured in elemental format.(P6)* *Some building needs salt and damp rising treatment first.(P11)* *Example for this project, there is changes of roof finishes so contractor proceeds with other works.(P12)*
7	Do not use "or equivalent" in the description.	50% (6/12)	50% (6/12)	*May depend on the case.(P7)* *However, Architect must confirm the material at early stage.(P8)*
8	Description should include gridline reference for each item of work.	64% (7/11)	36% (4/11)	*Yes, it helps. It all depends on the Architect who prepare the work scope on how to make contractor understand his intention.(P3)* *Only for taking-off purpose.(P4)* *May not be practical and would likely be cumbersome.(P6)* *For big project.(P9)* *Depends on the scope of work.(P10)* *Very important and useful during site valuation.(P11)*
9	Quantities must be firm quantity (NOT PROVISIONAL)	46% (6/13)	54% (7/13)	*To get as accurate as can before tendering. Proper preliminary dilapidation report must be carried out & confident with quantity. To minimise lack of producing report by agency that can lead to miss items and quantity.(P4)* *Depend on the type of building.(P5)* *In many cases, the quantities cannot be determined until the work is opened up.(P6)* *For some case difficult to get the actual area, can have an estimate for comparison and site measure later.(P7)* *Depends on how good the QS is.(P10)* *Certain item such as "replace rafters" or unfit timber board should be provisional. Actual damage only knows when open up during construction.(P11)* *There are items that need to remeasure.(P12)*

Table 5.3: Results for measured works bill – round 1 (continued)

10	Bill should be firm bill with quantities NOT provisional bill.	55% (6/11)	45% (5/11)	*Where possible!(P3)* *To get as accurate as can before tendering. Proper preliminary dilapidation report must be carried out & confident with quantity. To minimise lack of producing report by agency that can lead to miss items and quantity.(P4)* *In many cases, the quantities cannot be determined until the work is opened up.(P6)* *For some case difficult to get the actual area, can have an estimate lump sum for comparison and site measure later if needed.(P7)* *Depends on how good the QS is.(P10)* *Not necessary. Depend on condition of building and certainty on conservator justification.(P11)* *Lump sum contract. The BQ just for basic to price/Schedule of Rates.(P12)*

5.2.2.3 P.C. and Provisional Sum

Table 5.4 shows the results of Round 1 for questions on P.C. and Provisional Sum Bill. In this round, proposals 1 to 3 of Table 5.4 received consensus percentage while proposals 4 to 7 will be repeated in Round 2. The proposals that received consensus are listed below.

1. External Works should be given as P.C. Sum because works usually start one year later and calling tender nearer to the start date will ensure the cost is reflective of current market price
2. Purchase of material from overseas should be included in P.C. Sum due to the uncertainty during tendering period
3. Termite control treatment should be given as P.C. Sum because extent of damage difficult to determine during tendering

Meanwhile, proposals 4 to 7 received many comments from the panellists and all comments are shown in Table 5.4 and subsequently included in the Delphi Survey Round 2 questionnaire for the perusal and further decision of the panellists. The comments from the panellists suggest that the proposals on salt desalination treatment and rising damp treatment should be treated as a provisional quantity item (P11, P12, P6) instead of as P.C. and Provisional sum item. The panellists also commented that the quantity for the above three treatments can be determined (P7, P10). Due to the suggestion by the experts, the following new questions are included in the Round 2 Delphi Survey to determine the most suitable approach based on the experts' opinion.

1. Salt desalination treatment should be given as **Provisional Quantities** in the Main Works Bill.
2. Rising damp treatment should be given as **Provisional Quantities** in the Main Works Bill.
3. Termite control treatment should be given as **Provisional Quantities** in the Main Works Bill.

In the question pertaining to video recordings, panellist P4 and P6 commented the works for video recording can be allowed as Provisional sum and P4 further explained that the amount can be pre-determined by the agency. Another two panellists (P8, P10) disagreed with the proposal. Due to these comments, a new question as follow is included in the second round seeking the other experts' opinion on this matter.

> "Provision of video recordings of existing building conditions and the conservation process should be given as Provisional Sum."

Table 5.4: Results for P.C. and Provisional Sum bill – round 1

No.	Items	Agree	Disagree	Comments
1	External Works should be given as P.C. Sum because works usually start one year later and calling tender nearer to the start date will ensure the cost is reflective of current market price.	33% (4/12)	67% (8/12)	
2	Purchase of material from overseas should be included in P.C. Sum due to the uncertainty during tendering period.	85% (11/13)	15% (2/13)	
3	Termite control treatment should be given as P.C. Sum because extent of damage difficult to determine during tendering.	33% (4/12)	67% (8/12)	*In some case we can determine the area* (P7) *Not necessary. The cost is not big contributor, maximum RM4.00/m2* (P11)
4	Salt desalination treatment should be given as P.C. Sum because extent of salt attacks difficult to determine during tendering period.	50% (6/12)	50% (6/12)	*Allow as "Provisional Quantity of Rate"*(P11) *Provisional item (for remeasurement)* (P12) *In some case we can determine the area.*(P7) *Suggest Provisional Quantities; requiring final remeasurement.* (P6) *Subject to findings under preliminary dilapidation report. Some cases the agency themselves or specialist consultant may engage first for in depth preliminary dilapidation report. (P4)*
5	Rising damp treatment should be given as P.C. Sum because extent of rising damp difficult to determine during tendering period.	42% (5/12)	58% (7/12)	*QS can guestimate based on visual inspection.(P11)* *Rising damp is related to DPC which is based on meter run.(P10)* *In some case we can determine the area.(P7)* *Suggest Provisional Quantities; requiring final remeasurement.(P6)* *Subject to findings under preliminary dilapidation report. Some cases the agency themselves or specialist consultant may engage first for in depth preliminary dilapidation report.(P4)*
6	Technical visit to view similar restoration or material manufacturers should be given as P.C. Sum.	40% (4/10)	60% (6/10)	*Should be consultant scope of work before tender BQ and drawing and specification preparation.(P11)* *Sample to get and approval.(P12)* *Not necessary.(P10)* *Disagree. Unless visit to overseas or to other states.(P8)* *In some case we can determine the area.(P7)* *Should be under Provisional Sum.(P6)*
7	M & E Works should be given as P.C. Sum.	58% (7/12)	42% (5/12)	*M&E works can also call in one tender which park under main work.(P8)* *In some case we can determine the requirement and design.(P7)* *Suggest PC Sum to be used only if the M&E works are specialist in nature.(P6)*

5.2.2.4 Documents other than BQ

Table 5.5 shows the results of Round 1 for documents other than BQ. Documents other than BQ for tender are included in the questionnaire because these documents are mentioned by the interviewees in the semi-structured interviews as necessary documents to provide additional information during pricing for conservation project tenders. The additional documents suggested are listed below.

1. Schedule of Rates
2. Method Statement
3. Dilapidation Report
4. Historical Architectural Building Survey Report
5. Historical Report

Questions pertaining to the above documents are included in the Round 1 Delphi Survey questionnaire and all items pertaining to this section achieved the consensus percentage except for one item which is the proposal on "A new section should be created to incorporate method statement in the tender document". Comments from the panellist regarding this item indicates that some find the proposal useful (P11) and should be encouraged (P10) but some have doubts as one panellist (P3) contends that, "Sometimes the method statement is very specific for that particular work" while P4 suggests that contractor be given a choice to proposed their own method statement but the implementation of it will be subject to approval. Due to the differences in opinion, this proposal is again included in Round 2 of the Delphi Survey for the panellists' further consideration and decision.

Table 5.5: Results for documents other than BQ – round 1

No.	Items	Agree	Disagree	Comments
1	A Schedule of rates duly filled with a range of unit rates should be included in the tender document as a guide for tenderers due to unfamiliarity with conservation works.	67% (8/12)	33% (4/12)	
2	The existing method statements in the industry should be compiled to form a standard reference document.	91% (10/11)	1% (1/11)	
3	A new section should be created to incorporate method statement in the tender document.	64% (7/11)	36% (4/11)	*Yes, very useful especially for site supervision by COW during construction stage. (P11)* *This is encouraged. (P10)* *To submit by Contractor. (P6)* *Contractor have a choice to propose their method but subject to approval. (P4)* *Sometimes the method statement is very specific for that particular work.(P3)*
4	Dilapidation report should be included in the tender document.	75% (9/12)	25% (3/12)	
5	Dilapidation report should identify all damages in detail, marked the damages in the drawings and describe the accepted methods to repair the damages.	92% (11/12)	8% (1/12)	
6	Definition of HABS must be given clearly to reduce individual interpretation of HABS.	83% (10/12)	17% (2/12)	
7	Instructions on proper methods to prepare HABS and HABS reports should be included in the tender document.	83% (10/12)	17% (2/12)	
8	Historical study should be conducted and a report produced for reference.	92% (12/13)	8% (1/13)	

5.2.3 Results from Round 2 of Delphi Survey

Upon the completion of data analysis for Round 1, the questionnaire for Round 2 is prepared. The results of Round 1 together with the comments from the panellists are included in the second questionnaire. In addition, there are also new questions derived from the comments of Round 1. Similar to Round 1, the data collected are analysed using measures of central tendency, specifically the measure of mode. The results from Round 2 are presented in the tables below according to the same sections in Round 1.

5.2.3.1 Preliminaries

The first section is the Preliminaries Bill. The results for Round 2 are shown in Table 5.6 below. Both questions in this round pertain to the format of description for Preliminaries but each question proposes a different type of format. The first question is repeated from Round 1 and the second question is a new question derived from the comments received in Round 1. Both questions received the consensus percentage but the second question has a higher consensus percentage. This imply that although most of the experts agreed with the detailed format of description but a higher number of experts prefer the second format which is simple description of the preliminaries items.

The comments given by the panellists suggest that detailed information or additional information can always be referred to in other document such as Preambles or Specification (P4). The panellists also commented that guidelines by Jabatan Warisan Negara (P11) or Standard Method of Measurement (P4) can be used as reference or guidance by the contractors. Panellist P3 agreed to a simple description for Preliminaries items and reasons that there is a "conservator to provide the necessary advice". As such, the second proposal which is "Description for Preliminaries must be simple" will be included in the proposed guidelines.

Table 5.6: Results for Preliminaries bill – round 2

No.	Items	Agree	Disagree	Comments
1	Description for Preliminaries must be detailed **as per example below**. Information should include (where applicable) a. Sizes, b. Material, c. Composition and mix, d. Method of application/fixing, e. Source of material/labour, f. Approved test laboratory, g. Treatment methods, h. Quantity required. (Adapted from SMM2 & interviews) E.g. Execute the installation of datum point and datum line for the purpose of setting up grids. Gridlines should be demarcated using nylon strings measuring 1.00 x 1.00 meter to the surface of wall, floor and ceiling. Scaled photographs should be taken based on the fixed grids at all parts of the buildings before commencement of conservation works, during and upon completion of the works.	70% (7/10)	30% (3/10)	*Garis panduan Jabatan Warisan Negara would be an excellent attachment to append in Appendix/ reference to contractor.(P11)* *This information is not normally in the Preliminaries but is measured in the Main Works Bill.(P6)* *Also can refer to Preambles / Method of Measurement or Specification for further detail explanation since those documents complement each other with the BQ. Provided that all those Preambles / Method of Measurement or Specification were ready. I think it does not establish yet for conservation works.(P4)* *Yes most of special items like temporary store for the existing document or equipment, the scope of works of Conservator we spell out the details.(P12)* *Agree (P10)* *Put them in the BQ/Works detail description (P3)*
2	**Description for Preliminaries must be simple as per example below.** **E.g.** Scaled photographs should be taken based on the fixed grids at all parts of the buildings before commencement of conservation works, during and upon completion of the works.	82% (9/11)	18% (2/11)	*Agreed. Also can refer to Preambles / Method of Measurement or Specification for further detail explanation since those documents complement each other with the BQ. Provided that all those Preambles / Method of Measurement or Specification were ready. I think it does not establish yet for conservation works.(P4)* *For conservation works, the scaled photograph is included under HABS report. So under prelim we just mention the requirement of experiences Conservator and type of report to be prepare.(P12)* *Agree but the format of scaled photograph shall be approved by S.O.(P10)* *Agree. Since you will have the conservator appointed to give the necessary advice. (P3)*

Questions on the individual Preliminaries items that have not received consensus are repeated again in Round 2. Due to comments from panellists that indicate decision for inclusion in either the preliminaries or main works section is dependent on individual case, therefore the option of "case by case" basis is included in the second round of the survey. For example, comments from the panellist for the provision of archaeological test pit states inclusion of the item is "*depends on project. Some no need at all"* (P3) and "*depend on site"* (P9). Comment for the provision of exterior façade protection also indicates the same as mentioned by panellist P11, "for project in city, special façade hoarding may be required".

The result of the Preliminaries items for Round 2 is shown in Table 5.7. The opinions of the experts are quite diverse and thus there is no clear consensus with some items having no majority decision such as item 3, 4 and 8 which is as follows.

1. Provision for protection of exterior façade.
2. Provision for each type of lab tests required.
3. Provision of video recordings of existing building conditions and the conservation process.

The proposal "provision for protection of exterior façade" has received a slightly higher amount for inclusion in the Preliminaries (54%) as compared to Main Works (46%) in Round 1 but in Round 2, both sections received 40% each. However, due to the additional option of "case by case basis" in Round 2 the third option garnered a small percentage of agreement (20%). The result implies that the experts are divided in deciding where this work item should be included. In all probability, it can be in both sections and decision on which section should be based on the individual project. In Round 1, panellist P8 mentioned that "*if too specific, can be park under main works*". This indicates that the decision could also be hinged upon the specificity of the

requirements. Therefore, for this item, it is proposed that decision for its inclusion in either the Preliminaries section or Main Works section will depend on how specific the protection is needed.

For the proposal "provision for each type of lab tests required", it received equal numbers of agreement in both rounds for both sections, i.e. 50% each for Preliminaries and Main Works in Round 1 and 45% each in Round 2 with 10% agreement for a case by case decision. Again the opinion of the panellists is equally divided and further analysis is needed to arrive at a conclusion.

The third proposal with no clear consensus which is "provision of video recordings of existing building conditions and the conservation process" received a higher agreement for inclusion in the Preliminaries section (64%) as compared to Main Works (36%). However, upon the reiteration of this proposal in the second round the agreement from the panellists is now 45% each for Preliminaries and Main Works section and 10% for the "case by case basis" approach. Another dilemma for this work item is that comments from panellist P4 and P6 suggest for it to be considered as Provisional Sum item which would be in a different section of the BQ. In order to decide where the work item for "video recording" should be included, a new question is included in round 2 of the Delphi survey to find out if the panellist would agree for this provision to be a Provisional Sum item.

The feedback from Round 2 indicates that only one item which is "provision for protection of interior, railing, framing and furniture" should be included in the Preliminaries bill. There are 3 items that has majority of the panellists choosing it to be in the Main Works bill as listed below.

1. Provision for temporary struts/support structure
2. Provision for mock-up of lime plaster, painting and any other finishes that is needed
3. Provision for clearing of debris/vegetation before commencement of work

Item 1 of Table 5.7 which is "Provision of archaeological test pit of 1m x 1m" is also the only item that has majority of the panellists agreeing that it should be decided on a case by case basis. During the semi-structured interviews, one of the interviewees (R10) explains that the requirement for archaeological test pit would depend on the type of building. He gave an example where if the building to be conserved is the Parliament House then it is not necessary. On the other hand if the building is the birth home of one of our past Prime Minister, the archaeological test pit would be necessary to find information on the original construction materials or may even unearth some personal artefacts which have historical value.

Table 5.7: Results for Preliminaries items – round 2

No.	Items	Preliminaries	Main Works	Depends on case
1	Provision of archaeological test pit of 1m x 1m	27% (3/11)	18% (2/11)	55% (6/11)
2	Provision for protection of interior, railing, framing and furniture.	42% (5/12)	33% (4/12)	25% (3/12)
3	Provision for protection of exterior façade.	40% (4/10)	40% (4/10)	20% (2/10)
4	Provision for each type of lab tests required.	45% (5/11)	45% (5/11)	10% (1/11)
5	Provision for temporary struts/support structure.	36% (4/11)	45% (5/11)	18% (2/11)
6	Provision for mock-up of lime plaster, painting and any other finishes that is needed.	33% (4/12)	58% (7/12)	9% (1/12)
7	Provision for clearing of debris/vegetation before commencement of work.	27% (3/11)	63% (7/11)	10% (1/11)
8	Provision of video recordings of existing building conditions and the conservation process.	45% (5/11)	45% (5/11)	10% (1/11)

5.2.3.2 Measured Works

Round 2 of the Delphi survey also includes question on the Measured Works bill and the results are shown in Table 5.8. Only proposals 2, 4 and 6 as listed below has strong consensus in Round 2 of the Delphi Survey.

1. Proposed sequence for conservation works bills.
2. Description should include gridline reference for each item of work.
3. Bill should be firm bill with quantities NOT provisional bill.

Proposals 1, 3 and 5 which are as listed below did not reach the consensus percentage.

1. Items in the Conservation Works section should follow conservation works sequence which is top-down, i.e. starting with roof instead of work below ground.
2. Do not use "or equivalent" in the description.
3. Quantities must be firm quantity (NOT PROVISIONAL)

Further discussion on this result will be done in the analysis section.

Table 5.8: Results for measured works bill – round 2

No.	Items	Agree	Disagree
1	Items in the Conservation Works section should follow conservation works sequence which is top-down, i.e. starting with roof instead of work below ground.	63% (7/11)	37% (4/11)
2	Proposed sequence for conservation works bills. 1. Roof and Rainwater Goods 2. Floor Structure and Finishes 3. External Envelope 4. Internal Walls and Column and Finishes 5. Ceiling and Finishes 6. Staircase and Balustrade 7. Doors and Windows 8. Structural Works 9. Interior Fixtures and Fittings 10. Decoration Element 11. Treatment of Damp penetration, timber decay and associated work 12. Services	85% (6/7)	15% (1/7)

Table 5.8: Results for measured works bill – round 2 (continued)

3	Do not use "or equivalent" in the description.	42% (4/12)	58% (7/12)
4	Description should include gridline reference for each item of work.	73% (8/11)	27% (3/11)
5	Quantities must be firm quantity (NOT PROVISIONAL)	50% (5/10)	50% (5/10)
6	Bill should be firm bill with quantities NOT provisional bill.	73% (8/11)	27% (3/11)

5.2.3.3 P.C. and Provisional Sum

The following section on P.C. and Provisional Sum Bill has additional questions in Round 2 due to the comments of panellists in Round 1. The new questions attempt to find out the opinions of all panellists regarding the suggestions on salt desalination treatment, rising damp treatment and termite control treatment to be billed as provisional quantity item in the main works section as discussed in Section 5.2.2.3 above. The results show that most of the panellists agreed with the above suggestions with salt desalination treatment having 90% agreement for it to be treated as provisional quantity and rising damp treatment having 91% for the same suggestion. Termite control treatment has marginally lower agreement at 82% for the same suggestion. Another two more proposals received agreement from the panellists which are M&E works as P.C. Sum (73%) and video recording as Provisional Sum (75%). Majority of the panellists (73%) disagree with technical visit to be given as P.C. Sum. The results from Round 2 are as shown in Table 5.9 below.

Table 5.9: Results for P.C. and Provisional Sum bill – round 2

No.	Items	Agree	Disagree
1	Salt desalination treatment should be given as P.C. Sum because extent of salt attacks difficult to determine during tendering period.	60% (6/10)	40% (4/10)
2	Salt desalination treatment should be given as **Provisional Quantities** in the Main Works Bill.	90% (9/10)	10% (1/10)
3	Rising damp treatment should be given as P.C. Sum because extent of rising damp difficult to determine during tendering period.	40% (4/10)	60% (6/10)
4	Rising damp treatment should be given as **Provisional Quantities** in the Main Works Bill.	91% (10/11)	9% (1/11)
5	Termite control treatment should be given as **Provisional Quantities** in the Main Works Bill.	82% (9/11)	18% (2/11)
6	Technical visit to view similar restoration or material manufacturers should be given as P.C. Sum.	27% (3/11)	73% (8/11)
7	M & E Works should be given as P.C. Sum.	73% (8/11)	27% (3/11)
8	Provision of video recordings of existing building conditions and the conservation process should be given as Provisional Sum.	75% (9/12)	25% (3/12)

The last section in the questionnaire for Round 2 pertains to the Method Statement under the category of other documents other than BQ. The results and discussion on this data is given in the analysis section.

5.2.4 Proposal for Improvement to BQ

Subsequent to the findings on the adequacies of the BQ, a list of proposed changes as discussed in section 4.4.7 are derived from the interviews. The proposed changes are included in a questionnaire and the suitability of its use for conservation tender is validated using a 2-round Delphi survey method. The analysis on the feedback from the Delphi survey is presented below.

5.2.4.1 Improvement to Preliminaries

The guideline is separated into several parts based on the participants' feedback. The first part is pertaining to preliminaries. Some of the questions received consensus in the

first round and were not included in the questionnaire for the second round. Table 5.10 shows the items that received consensus in the first round. Consensus for this research is taken at 67% which means that all items that have achieved 67% and above either in agreement or disagreement will be considered to have achieved consensus. The rationale for this percentage is explained in section 3.4.1.

Table 5.10: 2/3 Consensus for Preliminaries items - round 1

No.	Items	Agree	Disagree
1	There should be a standard template for Preliminaries which consists of two sections.	90%	10%
1(a)	The first section covering general items such as contract, general facilities, mobilisation, insurance, water, access, etc. This section to be named General Preliminaries.	91%	9%
1(b)	The second section covering work specific to conservation such as HABS, Hammer Schmidt test, conservator, temporary roof, etc. This section to be named Conservation Related Preliminaries.	100%	0%
2	A standard rate should be included in the tender for specialist items such as conservator and HABS to avoid high variance between tenders. *E.g. Provision for conservator during the entire duration of project of 15 months at a salary of RM5,000/month.*	75%	25%

The first item in the questionnaire pertains to the general structure of the preliminaries. 90% of the panellists agreed that the standard template for preliminaries should consist of two sections. The first section is to be named General Preliminaries and should consist of items that are needed during the preliminary stage of work and as per the definition of SMM2 for building works. The second section received 100% agreement from the panellist. This section is to be named Conservation Related Preliminaries. Items to be included are preliminaries item that are related to conservation works only. Panellist P6 in agreement states that, 'This is to bring attention to Preliminaries items which are specific to conservation projects.' The items to be included in this Conservation Related Preliminaries section are as shown in Table 5.2. Item 2 of Table 5.1 proposes that a standard rate should be provided for specialist works such as consultancy work from conservator and provision of HABS. This proposal is derived from the semi-structured interviews where the interviewee suggested

this as one method to reduce the variance of the tender amount. However, 75% of the panellist agreed with this proposal while 25% disagreed. The panellists that disagreed are an Architect and a Quantity Surveyor from the Public Works Department and another Quantity Surveyor from Heritage Department. They did not provide any comment on why they disagreed with the proposal. Nevertheless this item is considered to have achieved consensus based on the research consensus level of 67%. The items in Table 5.10 cover the general format of the proposed preliminaries for conservation works and all these items will be used in the proposed guideline.

For the Preliminaries section, items that have not reached consensus in the first round were repeated again in the second round. In addition to the existing question, there is another new question to seek clearer clarification from the panellists in regards to the format for the description of Preliminaries item. The results of both round 1 and 2 for the repeated and new items are shown in the Tables 5.11.

Table 5.11: Results for Preliminaries - round 1 and 2

No.	Items	Agree		Disagree	
		R1	R2	R1	R2
1	Description for Preliminaries must be detailed **as per example below**. Information should include (where applicable) a. Sizes, b. Material, c. Composition and mix, d. Method of application/fixing, e. Source of material/labour, f. Approved test laboratory, g. Treatment methods, h. Quantity required. (Adapted from SMM2 & interviews) E.g. Execute the installation of datum point and datum line for the purpose of setting up grids. Gridlines should be demarcated using nylon strings measuring 1.00 x 1.00 meter to the surface of wall, floor and ceiling. Scaled photographs should be taken based on the fixed grids at all parts of the buildings before commencement of conservation works, during and upon completion of the works.	58%	70%	42%	30%

Table 5.11: Results for Preliminaries - round 1 and 2 (continued)

No.	Items	Agree		Disagree	
		R1	R2	R1	R2
2	**Description for Preliminaries must be simple as per example below.** **E.g.** Scaled photographs should be taken based on the fixed grids at all parts of the buildings before commencement of conservation works, during and upon completion of the works.	N/A	82%	N/A	18%

Note: R1= Round 1; R2= Round 2

Question 1 received 58% agreement and 42% disagreement in the first round and thus did not receive a clear consensus for this item. Therefore, this question was included again in the second round of the Delphi survey. Considering that there is no consensus for this proposal and also comment from one panellist that states, "Preliminaries to be kept simple as not to confuse the contractor" (P11), a new question (Question 2) on the same matter of description for preliminaries is added in the second round questionnaire.

In the second round, question 1 receives 70% agreement while question 2 receives 82% agreement. Although both questions have achieved consensus, it seems question 2 is more favourable with the panellists. This is in contrast with the feedback from the semi-structured interviews where the contractors would prefer the description for Preliminaries to have more detail information. Panellist P9 commented that the detail description for Preliminaries applies to category 1 building. Another panellist (P8) suggested that detail information can be included in the specification section. Adopting this suggestion may be able to appease both construction professionals and contractors where the preliminaries section can be kept simple and yet detail information can be referred to in the specification section to help contractors in pricing. Upon completion of Round 2, all questions asked under the category 'Format of Preliminaries' have received consensus from the panellists. The proposals will be included in the guideline.

The Delphi survey also asked for consensus on the specific items to be included in the proposed Conservation Related Preliminaries section. The items are derived from the semi-structured interviews conducted before the Delphi survey. The result from Round 1 is included in Table 5.12 for items which has reached consensus on its placing in the Conservation Related Preliminaries (CRP) section.

Table 5.12: 2/3 Consensus for Preliminaries items (CRP) - round 1

No.	Items	Preliminaries Section	Main Works Section
1	Provision of measured drawings before and after conservation works.	80%	20%
2	Provision of Dilapidation Report.	70%	30%
3	Provision for conservationist (or other related specialists) on site.	75%	25%
4	Provision for temporary roof covering.	67%	33%
5	Specify frequency of progress report needed (weekly), no. of copies needed and the format required.	77%	23%
6	Provision for technical visit to local and overseas site/factory if needed.	73%	27%
7	Provision for education/awareness exercise by installing information board and window for public to learn about the conservation process.	78%	22%
8	Provision for HABS1, HABS2 and HABS3	73%	27%
9	Provision for clause to manage archaeological find.	73%	27%

The above consensus covers the specific items of work that should be included in the proposed Conservation Related Preliminaries. These items will be used in the proposed guideline as it has received consensus from the panellists. The items that have not reached consensus in the first round were repeated again in the second round. The results of both round 1 and 2 for the residual items are shown in Table 5.13 below.

In the second round an additional column was added which is “depend on case”. This change came about after analysing the feedback from Round 1 where a number of

the panellists indicated that inclusion of the item of works should be on a case by case basis. Therefore, this new question is added in Round 2. Items that have received consensus in Round 1 were not included in Round 2 despite having a new category of "depend on case". This is because a clear consensus was obtained and this is construe as the decisiveness of the panellists' views on items listed in Table 5.13.

Table 5.13: Results for Preliminaries items (CRP) - round 1 and 2

No.	Items	Preliminaries		Main Works		Depends on case*
		R1	R2	R1	R2	R2
1	Provision of archaeological test pit of 1m x 1m	45%	27%	55%	18%	55%
2	Provision for protection of interior, railing, framing and furniture.	50%	42%	50%	33%	25%
3	Provision for protection of exterior façade.	54%	40%	46%	40%	20%
4	Provision for each type of lab tests required.	50%	45%	50%	45%	10%
5	Provision for temporary struts/support structure.	58%	36%	42%	45%	18%
6	Provision for mock-up of lime plaster, painting and any other finishes that is needed.	50%	33%	50%	58%	9%
7	Provision for clearing of debris/vegetation before commencement of work.	33%	27%	64%	63%	10%
8	Provision of video recordings of existing building conditions and the conservation process.	64%	45%	36%	45%	10%

Note: * New category in Round 2

The results from Round 2 indicate that some item of works cannot be determined definitely in which section it should stay. As there is no item commanding two thirds majority, decision on how the items should be managed will be based on simple majority. The average percentage will be calculated from both rounds to determine the mean percentage and the decision will be based on simple majority as shown in Table 5.14 below.

Table 5.14: Mean percentage from round 1 and 2: Preliminaries items (CRP)

No.	Items	Preliminaries	Main Works	Depends on case
1	Provision of archaeological test pit of 1m x 1m	36%	37%	55%
2	Provision for protection of interior, railing, framing and furniture.	46%	42%	25%
3	Provision for protection of exterior façade.	47%	43%	20%
4	Provision for each type of lab tests required.	48%	48%	10%
5	Provision for temporary struts/support structure.	47%	44%	18%
6	Provision for mock-up of lime plaster, painting and any other finishes that is needed.	42%	56%	9%
7	Provision for clearing of debris/vegetation before commencement of work.	30%	64%	10%
8	Provision of video recordings of existing building conditions and the conservation process.	55%	41%	10%

Referring to the above Table 5.14 on the mean percentage of total from Round 1 and Round 2, decision is made based on simple majority to determine the items to be included in the Conservation Related Preliminaries section as follows.

1. Provision for protection of interior, railing, framing and furniture.
2. Provision for protection of exterior façade.
3. Provision for temporary struts/support structure.
4. Provision of video recordings of existing building conditions and the conservation process.

Based on the same results, items that are to be included in the Main Works section are as follows.

1. Provision for mock-up of lime plaster, painting and any other finishes that is needed.
2. Provision for clearing of debris/vegetation before commencement of work.

The placing of "Provision of archaeological test pit of 1m x 1m" is to be decided on a case by case basis. The result for item of "Provision for each type of lab tests required" is split right in the middle in both rounds. This means that there are two schools of thoughts regarding this matter and findings from this research is unable to determine which section of BQ this item should be in. As such, for the purpose of the proposed guideline, the inclusion of item "provision of lab test" shall rests with the respective consultants that prepare the tender document.

5.2.4.2 Improvement to Measured Works

The following section presents data obtained from the Delphi survey pertaining to the measured works. In the first round, the following proposed format of the measured work bill that has consensus is shown in Table 5.15 below.

Table 5.15: Results for measured works item - round 1

No.	Items	Agree	Disagree
1	There should be a standard template for Measured works bill which consists of three sections namely Demolition, Conservation Works and New Works.	100%	0%
2	Items in the Demolition and New Works sections will remain status quo in accordance with the Standard of Measurement (SMM2) requirements.	91%	9%
3	Description of items of work should include (where applicable) i. Sizes, ii. Material, iii. Composition and mix, iv. Method of application/fixing, v. Source of material/labour, vi. Treatment methods, vii. Quantity required. viii. Supplier of special/original material ix. List of specialists x. Type of testing xi. Number of testing needed xii. Location of test samples to be taken xiii. Approved testing laboratory xiv. Reference for special works (Adapted from SMM2 and interviews)	78%	22%

Table 5.15: Results for measured works item - round 1 (continued)

No.	Items	Agree	Disagree
4	Related and/or similar works should be grouped together. *E.g. protection to railing to be included together with repair works to staircase INSTEAD of putting protection in Preliminaries Bill and repair works to staircase in Measured Works Bill.* *Testing for plastering to be put together with plastering work to wall INSTEAD of separating testing in Preliminaries Bill and plastering in Measured Works Bill.*	77%	33%
5	Do not use vague and all-encompassing description. Be specific. *E.g. Replace damage window frame with new frame and make good. [**vague**]* *Cut carefully damaged part of window frame marked X in drawing A and replace with similar frame sourced from list of supplier in Appendix X. Method of cutting and fixing to follow Method Statement 123.[**specific**]*	82%	18%

The above consensus covers the format that should be included in the proposed measured works bill for conservation works. Item 1 received 100% agreement from the panellist which proposes that the Measured Works Bill to be divided into three sub-sections demarcating the different type of work i.e. Demolition, Conservation Works and New Works. These items will be used in the proposed guideline as it has received consensus from the panellists. The items shown below have not reached consensus in the first round and are repeated again in the second round.

1. Items in the Conservation Works section should follow conservation works sequence which is top-down, i.e. starting with roof instead of work below ground.
2. Do not use "or equivalent" in the description.
3. Description should include gridline reference for each item of work.
4. Quantities must be firm quantity (NOT PROVISIONAL)
5. Bill should be firm bill with quantities NOT provisional bill.

Table 5.16 below shows the consensus received for the following four items.

1. Items in the Conservation Works section should follow conservation works sequence which is top-down, i.e. starting with roof instead of work below ground.
2. Proposed sequence for conservation works.
3. Description should include gridline reference for each item of work.
4. Bill should be firm bill with quantities NOT provisional bill.

Table 5.16: Consensus result for measured work – round 2

No.	Items	Agree		Disagree	
		R1	R2	R1	R2
1	Items in the Conservation Works section should follow conservation works sequence which is top-down, i.e. starting with roof instead of work below ground.	62%	63%	38%	37%
2	Proposed sequence for conservation works bills. 13. Roof and Rainwater Goods 14. Floor Structure and Finishes 15. External Envelope 16. Internal Walls and Column and Finishes 17. Ceiling and Finishes 18. Staircase and Balustrade 19. Doors and Windows 20. Structural Works 21. Interior Fixtures and Fittings 22. Decoration Element 23. Treatment of Damp penetration, timber decay and associated work 24. Services		85%		15%
3	Description should include gridline reference for each item of work.	64%	73%	36%	27%
4	Bill should be firm bill with quantities NOT provisional bill.	55%	73%	45%	27%

Although the percentage of Delphi panellists that agreed with item 1 in Round 2 only differs slightly from Round 1, the result still shows a consistent majority agreement although it did not achieve the consensus percentage of this research. Question 1 and 2 is similar and both are included in the questionnaire as a check. More panellists seem to disagree with item 1 but not item 2 of Table 5.16 although the meaning for both questions is the same. Nevertheless, the guideline will adopt the top down sequence for conservation project BQ as majority of the panellist agreed with this format. As

commented by one of the panellist (P3), "Agree. This is only a norm. We work from top to bottom as reflected in works bill but not restricted and always flexible at site."

For items 3 and 4 of Table 5.16, the agreement on the format has achieved the consensus percentage of this research. The guideline will incorporate the requirement for description to include gridline reference for each item of work and the measured works bill is encouraged to be produced as firm bill.

There are two items that do not have clear cut consensus in both rounds. The items are shown in Table 5.17 below.

Table 5.17: Non-consensus result for measured work - round 2

No.	Items	Agree			Disagree		
		R1	R2	Mean	R1	R2	Mean
1	Do not use "or equivalent" in the description.	50%	42%	46%	50%	58%	54%
2	Quantities must be firm quantity (NOT PROVISIONAL)	46%	50%	48%	54%	50%	52%

Although the difference between agreement and disagreement is small in both rounds, the mean results showed that slightly more than half of the panellists disagree with both the proposed format. For item 1, 54% of the panellists disagreed with the proposal not to use "or equivalent" and the reasons given by those that disagreed are as follows.

P6 – "Depends on the situation - whether only a particular product MUST be used or not."

P12 – "For government project, we can't specified 1[sic] brand. Also to prevent the specified supplier make-up [sic] their material rates."

P10 – "Disagree. Or-equivalent allows contractor to propose similar or better quality specified [sic] by the consultant."

The reason given by panellist P12 is due to government policy of not specifying only one brand to avoid price manipulation while P6 is concerned with the project requirement. Due to the majority that prefer having "or equivalent', the guideline will adopt the flexibility of "or equivalent" in the description although the feedback from the semi-structured interviews suggested to do away with the "or equivalent" description to standardized the rates.

The proposal to have "firm quantity" also met with a higher mean percentage of disagreement (52%) as compared to 48% that agreed with this proposal. The panellists gave the following reasons for disagreeing with the proposal.

P2 – "*Kuantiti mestilah 'provision' tertakluk kepada pengukuran setelah kerja siap*." [Translated: Quantities must be 'provision' [sic] subject to measurement upon completion of work.]

P6 – "In many cases, the quantities cannot be determined until the work is opened up."

P12 – "Certain items we don't know the actual conditions of the building. Like the salted [sic] plastered surface, only can determined the affected area after the contractor do the reading testing. The final quantity to remeasure."

P3 – "Very difficult to get firm grantity [sic]. Some elements maybe possible dependent on case to case."

Although in the earlier question, the panellist agreed to have a firm bill, they are also aware that not all items can be quantified accurately during the tendering period. Their reasons are in accord with the characteristics of conservation works where some works

are unknown until the work is opened up or until testing is conducted to reveal the extent of damage. Therefore, the suggestion from the semi-structured interviews of not having any provisional quantities for all items of work is not practical and this will not be incorporated into the guideline.

5.2.4.3 Improvement to P.C. and Provisional Sum

In the first round, three out of four items received consensus for the P.C. and Provisional Sum section. The panellists disagreed with two items and agreed to one item. The result is shown in Table 6.18 below.

Table 5.18: Results for P.C. and Provisional sum - round 1

No.	Items	Agree	Disagree
1	External Works should be given as P.C. Sum because works usually start one year later and calling tender nearer to the start date will ensure the cost is reflective of current market price.	33%	67%
2	Purchase of material from overseas should be included in P.C. Sum due to the uncertainty during tendering period.	85%	15%
3	Termite control treatment should be given as P.C. Sum because extent of damage difficult to determine during tendering.	33%	67%

For item 1 of Table 5.18, most of the panellists (67%) disagree to have External Works as P.C. Sum. The practice in the industry is to include External Works in the measured work bill but this convention was questioned by one of the interviewees and he suggested for External Works to be given as P.C. Sum. As this proposal is not accepted, the current practice will be maintained in the guideline where the External Works will be part of the measured work bill.

Item 2 of Table 5.18 is also a suggestion from the semi-structured interviews which is not in practice currently. The interviewee explains that due to the uncertainty in the

supply and price of materials which need to be purchased from overseas, having this item as P.C. Sum will reduce high variance in the tender due to different assumptions and risk avoidance strategies of the tenderers. This suggestion from the semi-structured interviews is included in the Delphi survey and it returns an 85% agreement to this proposal. Thus, the guideline will adopt this proposal.

Most of the Delphi panellists disagree (67%) with item 3 of Table 5.18. One of the panellists (P7) commented that "in some case [sic] we can determine the area". Another panellist (P11) states that "Not necessary. The cost is not big contributor, maximum RM4.00/m2". The current practice in the industry is to include termite treatment in the measured work bill. However, again the interviewee from the semi-structured interviews suggested having it as a P.C. Sum item and thus this proposal was included in the questionnaire for the Delphi survey. However, as the experts are not in agreement with this proposal, the guideline will not treat termite control treatment as P.C. Sum. However as this item is a type of treatment work, it is in a similar category of work with salt desalination treatment and rising damp treatment. As such, an additional question is included in Round 2 to determine if the termite control treatment should also be treated as a provisional quantity item similar to the earlier to treatment works.

Items that have not reached consensus in the first round are repeated again in the second round. In addition to the existing repeated question, four new items are also included in Round 2 based on the feedback from Round 1. The items are as follows.

1. Salt desalination treatment should be given as **Provisional Quantities** in the Main Works Bill.

2. Rising damp treatment should be given as **Provisional Quantities** in the Main Works Bill.
3. Termite control treatment should be given as **Provisional Quantities** in the Main Works Bill.
4. Provision of video recordings of existing building conditions and the conservation process should be given as Provisional Sum.

The results for the residual items from Round 1 and new items from Round 2 are shown in the Table 5.19 below.

Table 5.19: Results for P.C. and Provisional Sum results - round 1 & 2

No.	Items	Agree			Disagree		
		R1	R2	Mean	R1	R2	Mean
1	Salt desalination treatment should be given as P.C. Sum because extent of salt attacks difficult to determine during tendering period.	50%	60%	55%	50%	40%	45%
2	Salt desalination treatment should be given as **Provisional Quantities** in the Main Works Bill.	-	90%		-	10%	
3	Rising damp treatment should be given as P.C. Sum because extent of rising damp difficult to determine during tendering period.	42%	40%	41%	58%	60%	59%
4	Rising damp treatment should be given as **Provisional Quantities** in the Main Works Bill.	-	91%		-	9%	
5	Termite control treatment should be given as **Provisional Quantities** in the Main Works Bill.	-	82%		-	18%	
6	Technical visit to view similar restoration or material manufacturers should be given as P.C. Sum.	40%	27%	33%	60%	73%	67%
7	M & E Works should be given as P.C. Sum.	58%	73%	66%	42%	27%	34%
8	Provision of video recordings of existing building conditions and the conservation process should be given as Provisional Sum.	-	75%		-	25%	

Some of the above items have results from two rounds and in order to obtain the overall opinion of the panellists, the mean consensus is calculated for items with feedback from two rounds. Taking into consideration the feedback from Round 1, a

new question (item 2) is included in Round 2 to seek the opinion of the panellists for the most suitable approach for salt desalination treatment. The first proposed approach is to treat salt desalination treatment as P.C. Sum while the second proposal is to have the salt desalination treatment as provisional quantities in the measured works bill. The inclusion of item 2 is based on the feedbacks from Round 1 as follows.

P6 – 'Suggest Provisional Quantities; requiring final re-measurement.'

P11 – 'Allow as Provisional Quantity of Rate.'

P12 – 'Provisional item (for remeasurement).'

Both approaches also received agreement from the panellists. However the percentage of agreement is very much higher for the proposed approach in item 2 (90%) as compared to the propose approach in item 1 (55%). This would seem that although both approaches are agreeable to the panellists but most find that the second approach to be more suitable. Feedbacks from Round 2 are in agreement as seen in the comments given as follows.

P4 – 'Agree. Subject to re-measurement upon completion.'

P6 – 'Suggest Provisional Quantities; requiring final re-measurement.'

P11 – 'Salt desalination treatment is firm item and foreseeable during tender doc [sic] preparation. Not to be parked in P.C./Provisional Sum.'

P12 – 'Before tender the Architect can determine the area roughly when they prepared dilapidation reports. When we stated the quantity Provisional we can rationalized [sic] the rates and finally after re-measurement can get the competitive cost.'

As such, the guideline would adopt the second approach which is to have salt desalination treatment as provisional quantities in the Main Works Bill.

Item 3 also did not receive the consensus percentage of this research in Round 1 and thus the same question was asked again in Round 2. An additional question (item 4) on the same matter is included in Round 2 consequent from the feedbacks of Round 1. The question in Round 1 is proposing for rising damp treatment to be given as P.C. Sum because the extent of rising damp is difficult to determine during tendering period. However, some panellists do not agree as seen in the comments below.

P7 - 'In some cases we can determine the area.'

P11 – 'QS can guestimate [sic] based on visual inspection.'

Panellist (P6) commented 'suggest Provisional Quantities; requiring final re-measurement' and this suggestion is incorporated into the Round 2 questionnaire. Referring to Table 5.19, it can be seen that the panellists disagreed with the proposal regarding rising damp treatment as P.C. Sum in both rounds although the percentage did not achieved the consensus level. Nevertheless, it still shows that majority is in disagreement. On the other hand for item 4 which is rising damp treatment to be a provisional quantity, 91% of the panellists agreed with this proposal. The proposal of item 4 states that rising damp treatment should be given as provisional quantities in the measured works bill. As the consensus level is very high, this proposal will be incorporated into the guideline.

5.2.4.4 Improvement to Documents other than BQ

Data from the in-depth interviews found that other than the conventional BQ, there are also other documents which play an important part in the tendering process namely, Schedule of Rate, Method Statement, Dilapidation Report and the HABS and Research Report. The following proposals are not within the scope of the research but it is still included in the survey because the suggestions are derived from the semi-structured

interviews. As such, questions are included in the Delphi survey to obtain the opinions from experts regarding the use of these documents during tendering to provide better information for tenderers. The results from Round 1 are combined for all special documents and presented in Table 5.20.

Table 5.20: Results for documents other than BQ – round 1

No.	Items	Agree	Disagree
1	A Schedule of rates duly filled with a range of unit rates should be included in the tender document as a guide for tenderers due to unfamiliarity with conservation works.	67%	33%
2	The existing method statements in the industry should be compiled to form a standard reference document.	91%	1%
3	Dilapidation report should be included in the tender document.	75%	25%
4	Dilapidation report should identify all damages in detail, marked the damages in the drawings and describe the accepted methods to repair the damages.	92%	8%
5	Definition of HABS must be given clearly to reduce individual interpretation of HABS.	83%	17%
6	Instructions on proper methods to prepare HABS and HABS reports should be included in the tender document.	83%	17%
7	Historical study should be conducted and a report produced for reference.	92%	8%

The panellists agreed (67%) that a schedule of rates with a range of unit rates should be included in the tender document as reference to tenderers especially those that are still unfamiliar with conservation works. However, unlike new build works where there are official rates from the Public Works Department, there are no such information for conservation projects. As such, for this proposal to be implemented, there need to be a database available on the rates for conservation works.

A high consensus (91%) is obtained for the proposal of compiling method statements that are currently in use in the industry to be used as standard reference document.

Again the implementation of this suggestion cannot be immediate as there need to be further study on the existing method statement that is available and it suitability to be compiled as a reference document.

The proposal of including dilapidation report in the tender document also achieved the consensus (75%) in agreement of this proposal. However, the panellists that disagree provided their reason as follows.

P10 – 'It should be before tender.'

P12 – 'Presented in the site visit.'

Considering that the above comments are not strongly against the proposal but rather their opinion that the dilapidation report should be prepared before tender which is the norm, this proposal will be included in the guideline. The immediate implementation of this suggestion is possible as dilapidation report is usually prepared before a building is restored. However, the feedback from the semi-structured interviews suggested that the dilapidation report should be prepared in greater detail which will assist both the quantity surveyor in preparing detail descriptions of the works as well as the contractor in their pricing of the works. Majority of the panellists (92%) also agreed with having more details in the dilapidation report as proposed.

The semi-structured interviews reveal that while current tender documents included an item for the preparation of HABS, the description or specification for the required HABS is not spelled out clearly. This creates variability in the interpretation of the requirement as well as in the pricing of the works. Therefore a recommendation on the requirement to ensure a clear definition of HABS to be included in the description as well as instructions on the methods to prepare HABS is included in the Delphi survey to

obtain the opinion of the experts. The experts highly agreed (83%) with both recommendations and these recommendations will be incorporated into the guideline.

Under the category 'Documents other than BQ', only one item under Method Statement was repeated again in the second round because it did not achieve the consensus percentage in Round 1. The results of both Round 1 and 2 for this item are shown in the Table 5.21 below.

Table 5.21: Method statement results - round 1 and 2

No.	Items	Agree		Disagree	
		R1	R2	R1	R2
1	A new section should be created to incorporated method statement in the tender document.	64%	91%	36%	9%

The above item of work received a very strong consensus (91%) in agreement with the proposal in Round 2 of the Delphi survey. The panellists are very receptive towards this proposal with favourable comments as follows.

P10 – 'This is encouraged.'

P10 – 'Shall be prepared by consultant as guidance to bidders during tender process.'

The panellists also commented that this new section will be useful during the construction stage as per these comments.

P11 – 'Yes, very useful especially for site supervision by COW [Clerk of Work] during construction stage.'

P1 – 'It will reduce the time of scrutinised [sic] submission proposal by main contractor during construction stage.'

However, one panellist advises that 'Yes, this can be a standard one. However, M.S. (method statement) can be very specific and differ from one case to another'. This advice is very useful and should be taken into consideration when preparing a standard method statement for tendering. Nevertheless, due to the strong agreement, the proposal will be incorporated into the guidelines.

5.3 Proposed Guidelines for Conservation Works BQ

The findings from this research is compiled into tabular format for ease of reference and the findings are given as guidelines recommending how a BQ should be prepared that will reflect the needs and requirement of conservation works. The guideline covers not only the standard sections that are currently used in BQ of all type of works but also introduces new sections derived from the findings of this research. For items that return a clear consensus in the Delphi survey, it will be considered as a necessary inclusion in the BQ. For items that did not return a clear consensus, the decision on its inclusion in the BQ will depend on a case by case basis. The criteria for inclusion or exclusion will be given to guide users of the guideline to decide for themselves.

In producing these guidelines, it is clear that the document cannot stand alone because it only touches on the part where there is a need to change the current practice of preparing BQ to suit conservation tender. It is not an entire study on the taking-off, specifications, preambles and BQ preparation for conservation project which is too massive for this research. As such, the proposed guidelines cannot be compiled as a complete document for the preparation of BQ like the SMM2. However, the guidelines can be incorporated into the SMM2 to complement it. These proposals can provide a guide to the quantity surveyor in preparing conservation tender when currently there is

no rule or guidance available. Currently, the SMM2 is the industry standard for BQ preparation and measurement of quantity for new building works only.

However, as the SMM2 focus on new building works, incorporation of these proposed guidelines would only affect certain sections or may even require the addition of new section. Alternatively, these proposed guidelines could also form a supplementary document to the SMM2. With the addition of these guidelines, it would add to the comprehensiveness of the SMM2 whereby rules and guides for conservation works to heritage buildings are also available for reference by the industry.

The sections in the SMM2 that may be changed are Section A and B. Sections C onward of the SMM2 pertains to the measurement/taking-off rule for the different trades and it is not in the scope of this research to study on measurement rules. In both sections A and B, these proposed guidelines can be incorporated by forming new clauses under sub-title of Conservation Works. Suggestions on the new clauses are given in the final proposed guidelines. In the continuing section, the proposed guidelines are tabulated to allow for a systematic presentation as well as for ease of reference.

Firstly, the format for the tables is explained here. The tables are divided into four columns, the first column is for the numbering of each guideline to enable ease of reference. The second column refers to the section of BQ that the guidelines will be used in, which is divided into Preliminaries, Measured Works, P.C. and Provisional Sum. For the guidelines on "other documents", the second column refers to the type of documents the guidelines will be used for. The third column will contain the recommended guidelines that are derived from this study and the fourth column

contains the rationale for the guidelines. The fifth column proposes the relevant sections of SMM2 that the proposed guidelines can be inserted or added.

The proposed guidelines are divided into the following three tables according to the BQ sections and an additional table for the documents not forming the BQ but related to the tender document.

1. Table 5.22: Proposed Guideline for Preliminaries Bill
2. Table 5.23: Proposed Guideline for Measured Works Bill
3. Table 5.24: Proposed Guideline for PC and Provisional Sum Bill
4. Table 5.25: Proposed Guideline for Other Documents Related to Tender

Table 5.22 contains the guidelines pertaining to the Preliminaries section of the BQ which consists of seven (7) proposed clauses. The first item which is item 1.1 recommends that the Preliminaries bill should be in two sections. In the current practice, all Preliminaries items whether it is for general requirement, new build or conservation works are included in one section. Item 1.2 and 1.3 proceed to explain the name of the proposed new sections for Preliminaries shall be General Preliminaries and Conservation Related Preliminaries. The General Preliminaries section should covers general preliminaries items such as conditions of contract, general facilities, mobilization, insurance, water, access and other general preliminaries. This section would consists of items that are the same in new build works. It is proposed that a new clause to be added into the SMM2 as B.14 General Preliminaries for Conservation Works. The new clause of B.14 would provide the explanation and guides on what is to be included in this section.

The Conservation Related Preliminaries section is for preliminaries works that are specific to conservation only. The conservation works preliminaries items deemed suitable to be included here are HABS, testing of materials, provision of conservator, temporary roof, archaeological digs, protection to façade and interiors, dilapidation report, technical visit and other conservation requirement. A clause is proposed to be added into SMM2 as B.15 Conservation Related Preliminaries for Conservation works. The new clause of B.15 will list out the items that are to be included as a guide for quantity surveyors in the preparation of conservation works BQ.

Item 1.4 touches on the provision of standard rate or prime cost rate for conservator, HABS or other special items to be included in the Preliminaries as a guide for the tenderers' pricing. The reason is to mitigate the high differences in pricing this item due to the lack of information on the market price. This proposal is also to be included in the above-mentioned new clause of B.15 in SMM2. The reason for its inclusion in the proposed clause B.15 is because these item are included in this clause and thus it would be logical to add in the requirement for standard rates together with the relevant item. Item 1.5 states the work items that are to be included in the Conservation Related Preliminaries section which was validated in the 2-Rounds Delphi Survey. Again, this is proposed to be added in to the new clause of B.15. The items are as follows.

1. Provision of measured drawings before and after commencement of works.
2. Provision of dilapidation report.
3. Provision of conservationist on site.
4. Provision of other related specialist on site.
5. Provision for temporary roofing.
6. Provision for technical visit to local/overseas site/factory if needed.

7. Provision for education/awareness exercise for public.
8. Provision of HABS1, HABS2 and HABS3.
9. Management of archaeological find.
10. Provision for protection of interior, railing, framing and furniture.
11. Provision for protection of exterior façade
12. Provision for each type of lab tests required.
13. Provision of temporary struts/support structure.
14. Provision of video recording of existing building conditions and the conservation process.

The next item 1.6 explains the treatment for special conservation requirement which is the provision of archaeological pits. This work items may not be needed in every conservation project and thus its inclusion in the preliminaries are decided on a case by case basis. This provision is also suggested to be included in the new clause of B.15 in SMM2. The last clause on preliminaries which is item 1.7 explains that the description for preliminaries work items should not be in very detail but must be kept simple. Although the interviewees from the semi-structured interviews wanted the description to be in detail but the experts think differently and explained that it is better to have simple description for Preliminaries with the details given in the specification. Again, this is proposed to be in the same clause of B.15.

Table 5.22: Proposed guidelines for Preliminaries bill

No	Section	Recommendation	Rationale	Proposed Inclusion in Section in SMM2
1	Preliminaries			Section B
1.1		Preliminaries bill should consists of two sections	To enable the pricing level of preliminaries to be assessed easily.	
1.2		The first section is the General Preliminaries. This section is similar to the preliminaries section found in new build BQ and covers general items such as conditions of contract, general facilities, mobilization, insurance, water, access and other relevant preliminaries work.	General preliminaries are similar to new build works and therefore the pricing level should be similar. Having this section separate from conservation related preliminaries will enable the consultant to assess the reasonableness of the pricing level. Method of measurement to follow SMM2.	Proposed to be included in a new clause B.14. Proposed heading to be General Preliminaries for Conservation Works.
1.3		The second section is the Conservation Related Preliminaries. This section covers preliminaries works that are specific to conservation such as HABS, tests, provision of conservator, temporary roof, archaeological digs, protection, dilapidation report, technical visit and other relevant conservation requirement (see item 1.5).	Conservation related preliminaries may not have a standardized pricing level due to the uniqueness of each conservation project and therefore need to be separated to enable it to be assessed individually and on a case by case basis. Method of measurement to follow Note 1.	Proposed to be included in a new clause B.15 under the heading – Conservation Related Preliminaries for Conservation Works.
1.4		A standard rate or prime cost rate to be included for specialist items such as Conservator, HABS.	Having a prime cost rate for specialist items would provide a guide to each tenderer on the quality of work that is required and also to mitigate high variance due to difference assumption of quality by different tenderers.	Proposed to be included in the above new clause B.15.

Table 5.22: Proposed guidelines for Preliminaries bill (continued)

No	Section	Recommendation	Rationale	Proposed Inclusion in Section in SMM2
1.5	Preliminaries	Preliminaries items to be included in Conservation Related Preliminaries section: a) Provision of measured drawings before and after commencement of works. b) Provision of dilapidation report. c) Provision of conservationist on site. d) Provision of other related specialist on site. e) Provision for temporary roofing. f) Provision for technical visit to local/overseas site/factory if needed. g) Provision for education/awareness exercise for public. h) Provision of HABS1, HABS2 and HABS3. i) Management of archaeological find. j) Provision for protection of interior, railing, framing and furniture. k) Provision for protection of exterior façade l) Provision for each type of lab tests required. m) Provision of temporary struts/support structure. n) Provision of video recording of existing building conditions and the conservation process.	These items are commonly required in conservation works and may be costly. Therefore, to have a better picture of the pricing level for preliminaries, it is better to separate the costs for these items and to assess it on a case-by-case basis. All items except item (l) received consensus from the Delphi survey to be included in the preliminaries section. Item (l) has equal votes in both preliminaries and main work section with low votes for "depends on case". In order to decide at which section it should be included, item (l) is evaluated based on the definition of preliminaries as defined by SMM2 (see Appendix C).	Proposed to be included in the above new clause B.15.

Table 5.22: Proposed guideline for Preliminaries bill (continued)

No	Section	Recommendation	Rationale	Proposed Inclusion in Section in SMM2
1.6	Preliminaries	Preliminaries items to be included in Conservation Related Preliminaries section on a **"case-by-case"** basis: a) Provision of archaeological test pit of size 1m x 1m.		Proposed to be included in the above new clause B.15.
1.7		Description for Preliminaries must be simple.	Although findings from the interviews prefer detailed descriptions but feedback from Delphi survey prefers simple description for Preliminaries items. It is suggested that the Preliminaries to be read in conjunction with Preambles, Specifications and Method Statement.	Proposed to be included in the above new clause B.15.

The proposed guidelines for Measured Work are tabulated in Table 5.23 below. The numbering for measured works guidelines starts with 2.0 to signify that it belongs to a different section. Item 2.1 provides guidance on the type of BQ that is suitable for conservation works tender which is firm BQ with quantity. Although it is more tedious and time consuming to prepare, it is hoped that this guideline will encourage more firm BQ with quantity and less lump sum BQ. Having sufficient information in the BQ will assist the tenderers in their pricing and will reduce assumptions during pricing. Item 2.2 explains that if there are demolition works, conservation as well as new works in the project, the different type of works should be separated into different sections. The sections proposed for this bill is demolition works, conservation works and new works section. The rationale for this is to enable relevant assessment of pricing level for the different type of work in each section. It is suggested that this proposal to be added in the SMM2 under a new clause A.10 Work in Building Conservation.

Item 2.4 suggests the proposed sequence for the conservation works section in the measured works bill. However, it is not compulsory to follow the sequence in the exact order. The sequence can be adapted from this proposal to suit the individual conservation project. This proposal is also suggested to be included in the above-mentioned clause A.10 in SMM2. Item 2.5 suggests the information that should be included in the description for the items of work. This guideline is adapted from the SMM2 and validated by the experts in the Delphi Survey. It is also suggested to be included in clause A.10 as reference to the quantity surveyors when preparing BQ for conservation work items. Item 2.6 was a proposal given by an interviewee which provides that for item of works in the conservation section, related or similar works should be grouped together instead of going by other type of sequence which may separate works that are related by the work trade or element. Item 2.7 and 2.8 provides that description should be specific and also should include the gridline coordinates for ease of reference. These recommendations should be included in clause A.10 in SMM2.

Item 2.9 is the provision for mock-up to wall finishes such as lime plaster and painting to be stated together with the actual wall finishes work in the measured works bill. This suggestion is obtained from the semi-structured interviews and achieved consensus in agreement in the Delphi survey. The reason to include it together is to ensure that the cost of mock-up is not missed out in the tender. This recommendation is suggested to be added into the SMM2 under Section S, Clause S.1 Information. It can be included as a sub-clause to clause S.1. Item 2.10 is another recommendation to include provision of debris/vegetation in the measured works bill with the same rationale as above. It is suggested to add this recommendation in the new clause of A.10 in SMM2.

Item 2.11, 2.12 and 2.13 is the suggestions to provide for salt desalination treatment, rising damp treatment and termite control treatment as provisional quantities items in the measured works BQ. Remeasurement of the final quantities can be done upon the completion of work. In this approach, the risk to the contractor is lower and thus the mark-up will also be reduced. These three recommendations are suggested to be included in the new clause A.10 in SMM2.

Table 5.23: Proposed guideline for measured works bill

No	Section	Recommendation	Rationale	Proposed Inclusion in Section in SMM2
2.0	Measured Works			Proposed to be included in Section A.
2.1		Measured works bill should be firm bill with quantities.	Firm bill with quantities will provide a firm tender amount compared to lump sum bill.	
2.2		Measured works bill should consists of three sections which are: a) Demolition works section b) Conservation works section c) New works section	The three different sections reflect three different type of works and it would enable each section's pricing level to be assess accordingly.	Proposed to be included in a new clause A.10 under a heading – Work in Building Conservation
2.3		Items in the Demolition and New works section will be measured and described in accordance with the Standard Method of Measurement (SMM2).	SMM2 has rules and regulations in place for these two types of work.	
2.4		Proposed sequence for conservation works bills should be as follows: 1. Roof and Rainwater Goods 2. Floor Structure and Finishes 3. External Envelope 4. Internal Walls and Column and Finishes 5. Ceiling and Finishes 6. Staircase and Balustrade 7. Doors and Windows 8. Structural Works 9. Interior Fixtures and Fittings 10. Decoration Element 11. Treatment of Damp penetration, timber decay and associated work 12. Services	Although 85% agreed with this format, some qualify that this should be used as guidance only. The works can be combined or changed in accordance to the nature of the project.	Proposed to be included the above new clause A.10.

Table 5.23: Proposed guideline for measured works bill (continued)

No	Section	Recommendation	Rationale	Proposed Inclusion in Section in SMM2
2.5	Measured Works	For Conservation works section, description of items of work should include (where applicable). 1. Sizes, 2. Material, 3. Composition and mix, 4. Method of application/fixing, 5. Source of material/labour, 6. Treatment methods, 7. Quantity required. 8. Supplier of special/original material 9. List of specialists 10. Type of testing 11. Number of testing needed 12. Location of test samples to be taken 13. Approved testing laboratory 14. Reference for special works		Proposed to be included the above new clause A.10.
2.6		For Conservation work section, related and/or similar works should be grouped together.		Proposed to be included the above new clause A.10.
2.7		For Conservation work section, description should be specific. See example below. *Cut carefully damaged part of window frame marked X in drawing A and replace with similar frame sourced from list of supplier in Appendix X. Method of cutting and fixing to follow Method Statement 123.*		Proposed to be included the above new clause A.10.
2.8		For Conservation work section, description should include gridline reference for each item of work.		Proposed to be included the above new clause A.10.
2.9		Mock-up of lime plaster, painting and any other finishes that is needed should be included together with the same works in the measured works bill.	The interviewee explains that placing such work together will reduce the possibility of missing out the mock-up items during pricing.	Proposed to be included in Section S under clause S.1-Information.
2.10		Provision for clearing of debris/vegetation before commencement of work should be included in the measured works bill.	The interviewee explains that placing such work together will reduce the possibility of missing out the clearing of debris items during pricing.	Proposed to be included in new clause A.10.

Table 5.23: Proposed guideline for measured works bill (continued)

No	Section	Recommendation	Rationale	Proposed Inclusion in Section in SMM2
2.11	Measured Works	Salt desalination treatment to be given as provisional quantities item.	Quantities can be determined once the work is completed.	Proposed to be included in new clause A.10.
2.12		Rising damp treatment to be given as provisional quantities item.	Quantities can be determined once the work is completed.	Proposed to be included in new clause A.10.
2.13		Termite control treatment to be given as provisional quantities item.	Quantities can be determined once the work is completed.	Proposed to be included in new clause A.10.

The proposed guidelines for P.C. and Provisional Sum bill are tabulated in Table 5.24 containing six guidelines for this bill. Item 3.1.1 suggests that an amount to be allocated for purchases of material from overseas. This suggestion was derived from the feedback of the semi-structured interview where interviewees mentioned that it is difficult to price accurately for materials that may have to be purchase from overseas. As such, if an amount is allocated as P.C. Sum, the differences between tenderers are only due to their mark-up for profit and attendance and this would reduce the variance due to uncertain prices of overseas purchase. This recommendation is suggested to be added in a new sub-clause A.8 .2 in the SMM2. Item 3.1.2 also proposes that M&E works to be given as P.C. Sum instead of including it into the measured works bill. As this practice is currently prevalent in the industry, the findings in this study are just a validation of the suitability of the approach for M&E works.

Feedback from the Delphi survey shows that item 3.2.1 can be included in either the Preliminaries section or as Provisional sum. Considering that the percentage in agreement for item 3.2.1 is high, the guideline proposes that video recording of existing building conditions and the conservation process is included as Provisional Sum and a new clause A.8.3 to be added into the SMM2 as guidance in the preparation of BQ in the future.

Table 5.24: Proposed guideline for PC and Provisional Sum bill

No	Section	Recommendation	Rationale	Proposed Inclusion in Section in SMM2
3.0	Prime Cost and Provisional Sum			Proposed to be included in Section A
3.1	Prime Cost Sum			
3.1.1		Purchase of material from overseas to be given as Prime Cost Sum.	This would allow a sub-contract tender to be called nearer to the time when the material is needed so that the cost is reflective of the current market price.	Proposed to be included in clause A.8 under a new sub-clause A8.2.
3.1.2		M & E works to be given as Prime Cost Sum.	In accordance to the guideline provided in SMM2 under clause A.8	
3.2	Provisional Sum			Proposed to be included in Section A
3.2.1		Provision of video recording of existing building conditions and the conservation process.	Feedback from the Delphi survey shows that this item can be included in either the Preliminaries section or as Provisional sum.	Proposed to be included in clause A.8 under a new sub-clause A8.3.

The final part of the proposed guidelines pertains to documents other than BQ but related to the tender. There are five documents that this research found to be an important part of conservation project tender which are schedule of rate, method statement, dilapidation report, HABS and historical research report. Item 4.1 in Table 5.25 proposes for a schedule of rates to be included in the tender document with a range of rates as a guide to the conservation contractors to do their pricing. This proposal is from the semi-structured interviews and agreed upon by the experts in the Delphi Survey. This recommendation is suggested to be included in Section A of SMM2 under a new clause A.11 New Sections to be included in the Tender of Conservation Works. Item 5.1 proposes a new section in the tender document that contains standard method statements similar to the standard preliminaries section. This recommendation is also suggested to be added in the new clause A.11 of SMM2.

Item 6.1 pertains to the dilapidation report where the research found that it is required to be included in the tender document and proposes for its inclusion. In addition, the dilapidation report should report the damages in detail including recommending methods of repair. It is suggested that another new clause to be added to the SMM2 which is A.12 Other Documents to be included in the Tender for Conservation Works and item 6.1 to be added to this new clause.

While provision of HABS is already included in the current tender but the research found that the requirement and specification is not clear. Therefore, item 6.2 recommends that HABS must be defined properly and the requirement for the quality of HABS must be spelled out clearly. This recommendation is suggested to be included in the new clause A.12 in SMM2.

The final recommendation, item 6.3 pertains to historical research report. Although HABS is also a form of historical research report but from the semi-structured interviews, the feedback is that there is a need for a deeper study on the history of a heritage building before it is being restored. This provision is also suggested to be added to new clause A.12 in SMM2.

Table 5.25: Proposed guideline for other documents related to tender

No	Section	Recommendation	Rationale	Proposed Inclusion in Section in SMM2
4.0	Schedule of Rate			Proposed to be included in Section A in a new clause A.11 under the heading – New/revised sections to be included in the tender of conservation works.
4.1		A Schedule of rates duly filled with a range of unit rates should be included in the tender document as a guide for tenderers due to unfamiliarity with conservation works.		Proposed to be included in the above clause A.11.

Table 5.25: Proposed guideline for other documents related to tender (continued)

No	Section	Recommendation	Rationale	Proposed Inclusion in Section in SMM2
5.0	Method Statement	This is a new section that caters specifically for conservation works.		Proposed to be included in the above clause A.11.
5.1		There should be a standard reference section of method statement similar to the current standard specification section.		Proposed to be included in the above clause A.11.
6.0	Other Documents			Proposed to be included in Section A in a new clause A.12 under the heading – Other documents to be included in the tender of conservation works.
6.1	Dilapidation Report			Proposed to be included in the above clause A.12.
6.1.2		Dilapidation report should be included in the tender document.		
6.1.3		Dilapidation report should identify all damages in detail, marked the damages in the drawings and describe the accepted methods to repair the damages.		Proposed to be included in the above clause A.12.
6.2	HABS			Proposed to be included in the above clause A.12.
6.2.1		Definition of HABS must be given clearly to reduce individual interpretation of HABS.		
6.2.2		Instructions on proper methods to prepare HABS and HABS reports should be included in the tender document.		Proposed to be included in the above clause A.12.
6.3	Historical Research Report			Proposed to be included in the above clause A.12.
6.3.1		Historical study should be conducted and a report produced for reference.		

5.4 The Use of the Proposed Guidelines Internationally

Having the proposed guidelines for reference by the industry would improve the existing SMM2 to be on par with other international SMM such as NRM2, SSMM2, AAQS SMM and POMI where these standards have a section that is applicable as a guide for the measurement and preparation of BQ for works that are common in conservation work. In the NRM2, there is a clause that is specific for conservation

works while the rest of the sections are rules/guides for alteration works and other special works. Other standards such as SSMM2, AAQS SMM and POMI did not have any clause that is specific for conservation but has a section for alteration works.

The proposed guidelines although is designed from the conservation perspective, it can also be used for non-conservation alterations works such as refurbishment and renovation of new buildings. The proposed guidelines is more comprehensive than the existing international standards for alteration works due to the varied sections that it cover namely Preliminaries, Measured Works, P.C. and Provisional Sum and Other documents. Other international standards do not have any rules or guidelines pertaining to conservation works for Preliminaries, P.C. and Provisional Sum and did not specify the type of documents that are relevant and needed in a conservation project such as HABS.

Considering that the origin of the local SMM2 and the SSMM2, AAQS SMM and POMI is from the UK system, the proposed guidelines can be easily adapted for the use by these standards if it is found to be relevant. As the practice in conservation works in this country is usually based upon international convention, most of the work items stated in the proposed guidelines would be applicable in conservation works in other countries. However, the differences would be on the cost impact of these works as the labour and material costs in different country are different. As an example, if in Africa, it is still relatively easy to employ craftsmen to restore heritage building, the cost impact of labour would not be as great as it is in Malaysia. The issues as discussed in Section 4.4.2 and 4.4.3 will provide a point of reference for comparison with other countries on the impact of the factors identified on the cost of conservation works.

5.5 Summary

This chapter presents the findings from the two rounds of Delphi survey conducted. The development of the final guidelines is done carefully in a step by step manner from the findings. The draft guidelines are divided into four sections namely Preliminaries bill, Measured Work bill, P.C. & Provisional Sum bill and Documents other than bill of quantities. The outcome of this research provides guidance in the preparation of BQ for conservation works in terms of the format and information that is needed to be included in the BQ. Upon arriving at the outcome of the research in this chapter, the next chapter will conclude the research and also discusses the contribution and recommendation for future research.

CHAPTER 6: CONCLUSIONS AND RECOMMENDATIONS

6.1 Introduction

This chapter discusses the achievement of the research objectives and also highlight the conclusion of the research. Achievement of each objectives is discussed in detail supported by the findings of the study. At the end of this chapter, recommendations are made on areas that warrant further research.

6.2 Meeting Objective One

In any tender exercise, it is the norm that each tender price submitted will be different. It is also the objective of the tender exercise to obtain the most competitive price, i.e. the price that provides the best value for the project. While this is usually achieved in new build tenders, the same cannot be said for conservation works tenders. There is much anecdotal evidence that points to the problem of high variance in conservation projects. However, to determine if this phenomenon is true, this research compares the tender amounts of actual conservation project. Without comparing actual tender amounts, the research would not be able to determine if the feedback from the industry is true. The justification for the commencement of this research is dependent on the answer to the question on the variance of tender amount in conservation works.

The data obtained to achieve this objective shows that the tender variance amongst conservation projects tend to be higher than the norm in the industry. The findings show that conservation project has a CV value of 15% -22% which is higher when compared with the expected variance that is experienced in the industry for new build works. The CV value for all sections in the BQ of conservation project is also higher than new build works with the highest for preliminaries and conservation works

amount. With the achievement of this objective, the research has ascertain the pricing difference between tenders for conservation projects to be within the range of 15% - 22%. Although this percentage may not be generalised to represent the entire conservation tenders in the industry, it nevertheless, supports the anecdotal evidence that the variance in conservation tender is higher than the norm in the industry.

In addition to identifying the pricing difference, this research also endeavour to identify the reasons for the high variance to provide a deeper insight into the phenomenon. The research discovered that variance in conservation tenders are caused by four factors which are hidden or unforeseen works due to existing building condition, contractors' inexperience in conservation works, weaknesses in the bills of quantities and the unpredictable cost of labour and material. Thus, the findings give support to the anecdotal feedback and also provide the rationale for this research to proceed.

6.3 Meeting Objective Two

The first objective has provided the scenario where the tender variance for conservation project is high. Upon discovering this, the next objective is to determine the state of adequacy of the BQ used for such tenders. The reason for pinpointing the BQ is because BQ is the section of the tender document where the cost is calculated. Therefore, it is logical that this would be the first place to be looked at for any matters that pertains to cost. In view of this, the research has to know if the BQ used is suitably prepared for the purpose of costing conservation works. Considering that the measurement method for all types of building works follows the Standard Method of Measurement 2 produces by The Royal Institution of Surveyors Malaysia, the part of

quantity in the BQ is deemed to be in accordance to industry standard. This then leave the description part of the BQ to be in question.

A BQ consists of two main parts which are the quantity and the description and both parts are equally important in the calculation of the cost of each work item. The description contains pertinent information for the use of costing as well as for construction and therefore, the second objective intends to determine if the information provided in the BQ of existing conservation works tender is sufficient for costing purpose.

In addition to the quantity and description, BQ can also be prepared in differing formats to suit the type of work that is being tendered. Taking this into consideration, the existing format of BQ for conservation project tender is also being scrutinized for its suitability. The method use in achieving this second objective is by engaging the most relevant stakeholder which is the conservation works contractors who calculate the tender amounts. The instrument use in this step is in-depth semi-structured interviews with conservation works contractors.

The findings from the in-depth interviews reveal three major themes pertaining to the adequacy of the BQ. The three themes point to BQ-related inadequacies, Specification-related inadequacies and inadequacies of other documents. The analysis conducted also reveals five sub-themes for BQ-related inadequacies which suggest the area of weakness in the BQ. One of the weakness points to the non-standardisation of format for BQ of conservation works. The non-standardisation of format also relates to the confusing arrangement or sequence of existing BQ. Other weaknesses pertain to the incomplete description and information in the BQ which result in contractors making assumptions for pricing. The sub-themes for Specification-related inadequacies reveals

three weakness in specification which are the specifications are generic and not specific to conservation works, the existing specification is not complete for conservation works and there is no standard specification for conservation works. The analysis also reveals inadequacies of other documents that are not part of the BQ but are usually found in the tender documents. The respondents reveal that these documents play an important part in the pricing of the tender. The sub-themes reveal that there is usually no method statement in the tender document to guide the contractors in pricing. Another failing is the lack of standardisation in the format of HABS and preliminary historical studies on the building to be conserved.

Thus, the above findings found that the tender document that is prepared for conservation tender has inadequacies that affect the pricing of the tender in both the format as well as the sufficiency of information.

6.4 Meeting Objective Three

Having met objectives one and two, the third and final objective for this research produces the final outcome which is the guidelines for use in the preparation of BQ for conservation works. In order to achieve this objective, the proposed guidelines are derived from the findings of the semi-structured interviews and the guidelines are checked and validated through Delphi survey method. The final guidelines are built up item by item from the feedbacks of the Delphi survey method. In the effort to standardise the guidelines with the practice in the industry, the guidelines are divided into separate sections according to sections commonly found in a standard BQ which are Preliminaries, Measured Work and P.C. and Provisional Sum. However, this study also yielded guidelines for additional documents such as Schedule of Rates, Method

Statement, Dilapidation Report, HABS and Historical Research Report. The discussion below will describe the guidelines according to the sections mentioned above.

6.4.1 Guidelines for Preliminaries

Feedback on the guidelines for preliminaries items are confirmed through two rounds of the Delphi survey method. In the first round, four items received consensus to be included as guidelines as follows.

1. There should be a standard template for Preliminaries which consists of two sections (90% in agreement).
2. The first section covering general items such as contract, general facilities, mobilisation, insurance, water, access, etc. This section to be named General Preliminaries (91% in agreement).
3. The second section covering work specific to conservation such as HABS, Hammer Schmidt test, conservator, temporary roof, etc. This section to be named Conservation Related Preliminaries (100% in agreement).
4. A standard rate should be included in the tender for specialist items such as conservator and HABS to avoid high variance between tenders (75% in agreement).

In the second round, an additional two more items received consensus to be included as guidelines as follows.

1. Description for Preliminaries must be detailed as per example below. Information should include (where applicable) (70% agreed in round 2)
    a. Sizes,
    b. Material,
    c. Composition and mix,

d. Method of application/fixing,
e. Source of material/labour,
f. Approved test laboratory,
g. Treatment methods,
h. Quantity required.

2. Description for Preliminaries must be simple as per example below (82% agreed). This guideline is a new proposal based on the feedback from round 1.

In addition to the formatting guidelines for Preliminaries, this research also established the contents that should be included in the conservation related section of the preliminaries. The following items obtained consensus from the experts during round 1.

1. Provision of measured drawings before and after conservation works (80% agreement).
2. Provision of Dilapidation Report (70% agreement).
3. Provision for conservationist (or other related specialists) on site (75% agreement).
4. Provision for temporary roof covering (67% agreement).
5. Specify frequency of progress report needed (weekly), no. of copies needed and the format required (77% agreement).
6. Provision for technical visit to local and overseas site/factory if needed (73% agreement).
7. Provision for education/awareness exercise by installing information board and window for public to learn about the conservation process (78%).
8. Provision for HABS1, HABS2 and HABS3 (73%).
9. Provision for clause to manage archaeological find (73%).

Items that did not received consensus are repeated in the second round of the Delphi survey. However, in the second round, the following items also did not managed to obtain a clear consensus and such decision are made based on simple majority of the mean percentage of both round 1 and round 2. Based on the Delphi survey, the following items are to be included in the conservation related preliminaries.

1. Provision for protection of interior, railing, framing and furniture (mean of 46% agreed).
2. Provision for protection of exterior façade (mean of 47% agreed).
3. Provision for each type of lab tests required (mean of 48% agreed).
4. Provision for temporary struts/support structure (mean of 47% agreed).
5. Provision of video recordings of existing building conditions and the conservation process (mean of 55% agreed).

The majority of the experts decide that the item on "provision of archaeological test pit" is to be decided based on a "case-by-case" basis while provision of mock-up and clearing of debris/vegetation should be in the main (measured) works section. All guidelines for Preliminaries are proposed to be incorporated into the SMM2 under Section B as the existing Section B deals with all matters pertaining to Preliminaries.

6.4.2 Guidelines for Measured Works

Guidelines for the measured works are similarly decided by experts through the Delphi survey. In round one there are five items that received consensus to be included in the guidelines for measured works. These items are as follows.

1. There should be a standard template for Measured works bill which consists of three sections namely Demolition, Conservation Works and New Works (100% agreement).

2. Items in the Demolition and New Works sections will remain status quo in accordance with the Standard of Measurement (SMM2) requirements (91% agreement).
3. Description of items of work should include (where applicable) (78% agreement).
    a. Sizes,
    b. Material,
    c. Composition and mix,
    d. Method of application/fixing,
    e. Source of material/labour,
    f. Treatment methods,
    g. Quantity required.
    h. Supplier of special/original material
    i. List of specialists
    j. Type of testing
    k. Number of testing needed
    l. Location of test samples to be taken
    m. Approved testing laboratory
    n. Reference for special works
4. Related and/or similar works should be grouped together (77% agreement).

    E.g. protection to railing to be included together with repair works to staircase INSTEAD of putting protection in Preliminaries Bill and repair works to staircase in Measured Works Bill.

5. Do not use vague and all-encompassing description. Be specific (82% agreement).
    a. E.g. Replace damage window frame with new frame and make good. [vague]
    b. Cut carefully damaged part of window frame marked X in drawing A and replace with similar frame sourced from list of supplier in Appendix X. Method of cutting and fixing to follow Method Statement 123.[specific]

Round 2 yields further three items to be included in the guidelines for measured works.

1. Proposed sequence for conservation works bills (85% agreed).
    a. Roof and Rainwater Goods
    b. Floor Structure and Finishes
    c. External Envelope
    d. Internal Walls and Column and Finishes
    e. Ceiling and Finishes
    f. Staircase and Balustrade
    g. Doors and Windows
    h. Structural Works
    i. Interior Fixtures and Fittings
    j. Decoration Element
    k. Treatment of Damp penetration, timber decay and associated work
    l. Services
2. Description should include gridline reference for each item of work (73% agreed).
3. Bill should be firm bill with quantities NOT provisional bill (73% agreed).

The following two items are included in the measured works guidelines based on the feedbacks from the preliminaries section.

1. Provision for mock-up of lime plaster, painting and any other finishes that is needed (mean of 56% agreed).
2. Provision for clearing of debris/vegetation before commencement of work (mean of 64% agreed).

Additional guidelines are also included in the measured works section based on feedbacks from the P.C. and Provisional Sum section. The experts agreed to have the following works to be given as provisional quantities items in the measured works bill instead of as provisional sum.

1. Salt desalination treatment to be given as provisional quantities item.
2. Rising damp treatment to be given as provisional quantities item.
3. Termite control treatment to be given as provisional quantities item.

The above guidelines are proposed to be incorporated into Section A – General Rules of the SMM2. Due to no existing clause is relevant to conservation works, it is further proposed that a new clause A.10 – Work in Building Conservation is created.

6.4.3 Guidelines for P.C. and Provisional Sum

The guidelines for P.C. and Provisional Sum are much more difficult to establish with only three items received consensus in the first round of the Delphi survey. The item that the experts agreed should be included in the P.C. and Provisional Sum section is the "purchase of material from overseas" which received 85% agreement. The experts disagreed that "external works" and "termite control treatment" to be given as P.C. Sum with both receiving 67% in disagreement. Upon completion of round two,

only two more items are included as guidelines. The proposal for "technical visit to view similar restoration or material manufacturers" to be treated as P.C. Sum received disagreement from the experts and thus it will not be included as guideline in the P.C. and Provisional Sum section.

As mentioned above, items for salt desalination treatment, rising damp treatment and termite control treatment is included in the measured works section as provisional quantities. Only the following items received agreement from the experts to include it as guidelines in the P.C. and Provisional Sum section.

1. M & E Works to be given as P.C. Sum (mean of 66% agreement).
2. Provision of video recordings of existing building conditions and the conservation process to be given as Provisional Sum (75% agreement).

The above guidelines are proposed to be incorporated into the SMM2 under Section A – General Rules under clause A.8 – Provisional and Prime Cost Sums. However, new sub-clauses should be created for the new guidelines.

6.4.4 Guidelines for Documents other than BQ

Although the title states that these guidelines are not for BQ but it is still included in this research because the stakeholders in conservation namely the contractors and professionals consider it important for tender pricing. The items that received agreement from the experts are as follows.

1. A Schedule of rates duly filled with a range of unit rates should be included in the tender document as a guide for tenderers due to unfamiliarity with conservation works (67% agreement).

2. The existing method statements in the industry to be compiled to form a standard reference document (91% agreement).
3. Dilapidation report to be included in the tender document (75% agreement).
4. Dilapidation report must identify all damages in detail, marked the damages in the drawings and describe the accepted methods to repair the damages (92% agreement).
5. Definition of HABS must be given clearly to reduce individual interpretation of HABS (83% agreement).
6. Instructions on proper methods to prepare HABS and HABS reports to be included in the tender document (83% agreement).
7. Historical study to be conducted and a report produced for reference (92% agreement).
8. A new section to be created to incorporated method statement in the tender document (91% agreement).

The above guidelines are proposed to be incorporated into Section A – General Rules of the SMM2 but new clause of A.11 – New/revised section to be included in the tender of conservation works to be created for both Schedule of Rates and Method Statement. Another new clause A.12 – Other documents to be included in the tender of conservation works is proposed to be created to cater for guidelines on Dilapidation report, HABS and Historical research report.

It is hoped that these guidelines can help to standardize the way a BQ is prepared for conservation project and thus allowing for better price and cost management of conservation works. The research also proposes that this guideline to be incorporated into the SMM2 to facilitate the implementation as opposed to it being a separate

document. Being in the SMM2 also gives it the necessary formal standing and recognition as well as having gained the approval from the quantity surveying profession.

6.5 Contribution to Knowledge

This research is initiated due to the issue of high variance in conservation tender that is currently faced by the construction industry. This issue creates difficulty for both consultants and client in evaluating tenders and deciding the most competitive tender. As such, this research aims to establish guidelines for bills of quantities that are relevant and reflective of the special works involved in the building conservation process which would enable accurate cost estimating of such works. This research attempts to contribute to knowledge by conceptualising the above issues as research question on how should bills of quantities look like to be relevant and suitable for use in building conservation works. This question is based on the premise that BQ is used for pricing and therefore a BQ must be clear and complete to enable the price of all necessary works are included in the tender amount. Thus in the process of reaching the outcome of this research, the contribution to knowledge is not only limited to the final outcome of the research.

The variance of tender amount for new building works has been studied in various studies as discussed in chapter 2 but tender variance of conservation works thus far has not been researched. As such this research contributes to the understanding of tender pricing for conservation works from the findings of the semi-structured interviews.

In addition to new knowledge on tender pricing for conservation works, the use of Delphi survey method to obtain further information and act as a triangulation method to

validate the findings of the semi-structured interviews is a fresh approach for research in the construction field. This method is useful and relevant for the construction industry due to the nature of construction works that are unique and the stakeholders are usually specialist in their own field.

The most important contribution would be the formulation of guidelines to prepare Bills of Quantity for conservation project. The proposed guidelines contributes and add-on to the existing guidelines contained in The Standard Method of Measurement for Building Works 2 (SMM2). The existing SMM2 provides guidelines in the preparation of BQ for new building works while this research produces new guidelines which are specific for building conservation works. The proposed guidelines cover the various sections of a BQ namely, the Preliminaries bill, the Prime Cost and Provisional Sum bill and the Measured Works bill. Guidelines for each bill is tabulated as shown in Table 6.1 to 6.5 indicating where each proposed guideline should be inserted in the SMM2. This is to indicate clearly how the guidelines are related to the sections in SMM2 and to ease its implementation in the future.

6.6 Recommendations for Future Research

While conducting this research, there are various phenomenon that fall outside the scope of this research and thus could not be investigated here. Therefore, it is hoped that in future, the following recommendations can be researched to increase the knowledge base of quantity surveying studies in the building conservation industry.

1. A comprehensive study to look into producing standard method statement for use in conservation projects.
2. A comprehensive study to look into producing standard specifications specific for conservation projects.

3. An extensive research to produce standard rates and cost index for items of work in building conservation.
4. With the hope that this proposed guideline will be used in the industry, a follow-up study can be conducted on the effectiveness of this proposed guidelines and to proposed necessary amendments for further improvement.

6.7 Summary

This chapter provides the summary and conclusion of the research. The achievement of each objective is recapitulated in the discussion comprises the variance level of tenders for conservation works, the reasons for such variance, the adequacy of the tender and BQ documents. This chapter concludes with the presentation of the final guidelines and the contribution of this research as well as the recommendation for future research.

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LIST OF PUBLICATIONS AND PAPERS PRESENTED

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Paper Publication

1. Lim, Y.M. & Yahaya, A. (2015). Barriers to Competitive Tenders in Building Conservation Works. *International Journal of Social, Behavioral, Educational, Economic, Business and Industrial Engineering*, 9(3), 804-809

2. Yoke Mui, L., Ahmad, Y., & Nabavi, F. (2016). Causes of high variance in building conservation tenders in Malaysia. *Structural Survey*, 34(2), 98-116. (Emerald Literati Network Award for Excellence 2017 - Highly Commended Paper)

Conference Presentation

1. Paper presented on "A Comparison Analysis of Tender Price for Building Conservation and New Build Project in Malaysia" at the Malaysia-Japan Phd Conservation Research Colloquium 2013, Waseda University, Tokyo, 22 Oct 2013.

2. Paper presented on "Formulation of a New Format for Building Conservation Bill of Quantity." International Symposium on Nusantara Cultural Heritage (INCH), University of Sumatera Utara, 26 - 30 Nov 2016.

APPENDICES

APPENDIX A

Questionnaire for Semi-Structured Interview

APPENDIX B

Questionnaire for Delphi Survey

APPENDIX C

Extract of SMM2 – Section A & B

APPENDIX D

Comparison between SMM2, NRM2, SSMM2, AAQS SMM and POMI

Comparison of Contents between SMM2, NRM2, SSMM2, AAQS SMM and POMI

SMM2	NRM2	SSMM2	AAQS SMM	POMI
General Rules	Preliminaries	General Principles	General Instructions	General Principles
Preliminaries	Off-site manufactured materials, components and buildings	Preliminaries	Preliminaries	General Requirement
Demolition	Demolitions	Demolitions & Alterations	Demolitions	Site Work – Demolition and Alterations
Excavation & Earthworks	Alterations, repairs and conservation	Piling & Diaphragm Walling	Alteration	Concrete Work
Piling & Diaphragm Walling	Excavating and filling	Excavation	Earthworks	Masonry
Concrete Work	Ground remediation and soil stabilisation	Concrete Works	Lateral Support	Metalwork
Brickwork & Blockwork	Piling	Brickwork & Blockwork	Ground Anchoring	Woodwork
Underpinning	Underpinning	Asphalt Work	Piling	Thermal & Moisture Protection
Masonry	Diaphragm walls and embedded retaining walls	Masonry	Concrete, Formwork & Reinforcement	Doors & Windows
Waterproofing and Asphalt Work	Crib walls, gabions and reinforced earth	Roof ing	Precast Concrete	Finishes
Roofing	In-situ concrete works	Carpentry & Joinery	Masonry	Accessories
Woodwork	Precast/composite concrete	Ironmongery	Waterproofing	Equipment
Structural Steelwork	Precast concrete	Structural Steelworks	Roof Coverings, Cladding, etc	Furnishings
Metalwork	Masonry	Metalwork	Carpentry & Joinery	Special Construction
Plumbing & Mechanical Engineering Installation	Structural metalwork	Wall & Ceiling Finishings	Ceilings, Partitions & Access Flooring	Conveying Systems
Electrical Installation Floor,	Carpentry	Floor Finishings	Floor Coverings, Wall Lining, etc	Mechanical Engineering Installations
Wall & Ceiling Finishes	Sheet roof coverings	Plumbing	Ironmongery	Electrical Engineering Installations

Comparison of Contents between SMM2, NRM2, SSMM2, AAQS SMM and POMI (Continued)

SMM2	NRM2	SSMM2	AAQS SMM	POMI
Glazing	Tile and slate roof and wall coverings	Mechanical Installation	Structural Steelworks	
Painting and Decorating	Waterproofing	Electrical Installation	Metalwork	
Drainage	Proprietary linings and partitions	Glazing	Plastering	
Fencing, Turfing and Planting	Cladding and covering	Painting & Decorating	Tiling	
	General joinery	Drainage Work	Plumbing & Drainage	
	Windows, screens and lights		Electrical Work	
	Doors, shutters and hatches		Mechanical Work	
	Stairs, walkways and balustrades		Glazing	
	Metalwork		Paintwork	
	Glazing		Paperhanging	
	Floor, wall, ceiling and roof finishings		External Work	
	Decoration			
	Suspended ceilings			
	Insulation, fire stopping and fire protection			
	Furniture, fittings and equipment			
	Drainage above ground			
	Drainage below ground			
	Site works			
	Fencing			
	Soft landscaping			
	Mechanical services			
	Electrical services			
	Transportation			
	Builder's work in connection with mechanical, electrical and transportation installations			

Source: Extracted from SMM2, NRM2, SSMM2, AAQS SMM and POMI

APPENDIX E

Extracts from NRM2, SSMM2, AAQS SMM and POMI