DETERMINANTS OF COST VARIANCES IN BUILDING CONSERVATION WORKS

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ABSTRACT

More often than not, building conservation projects are completed with high cost and high time variances (Ali *et al*, 2009), which, in part is due to the uncertainty in actual work needed to conserve the building (Rayers and Mansfield, 2001). Also, difficulty exists for cost estimators who are unfamiliar with building conservation works to estimate accurately. Realising the predicament in producing an accurate estimate, a study was conducted to identify the hidden costs of building conservation works, specifically the work items that contribute to such hidden cost. A total of 16 respondents who have been involved in building conservation projects in Malaysia are surveyed using postal questionnaire. Twenty five (25) work items that are specific to building conservation works are identified and the survey attempts to determine the main work items. Based on the results, these 25 special work items are grouped into four main categories, namely Research and Documentation, Scientific Studies, Laboratory Tests and Temporary Works. From the survey, work items such as 'Carbonation Test', 'NIPGAT Test', 'Petrography Test', and 'Covermeter Survey' are found to have the highest Relative Index value. This study concludes with a list of work items that encountered in building conservation works for quantity surveyor's reference to prepare the cost estimate in future.

KEYWORDS

Estimation, Hidden cost, Conservation, Malaysia, Construction

1.0 Introduction

Building conservation relates specifically to the process of repair, maintenance and restoration of historic buildings (Fielden, 1996) which aims to prolong a building's life and functions. According to Dr. Ghafar Ahmad (1994a), a conservation architect in Malaysia, conservation by definition is guardianship providing for maintenance, preservation or protection of what presently exists, from being destroyed or changed in an appropriate manner. The main concern in carrying out any preservation work is to retain as much as possible the original characters of the building (Ahmad, 1998). In Malaysia, building conservation practice is relatively new (Kamal *et.* Al, 2008) compared to some other countries.

Building conservation works in Malaysia are generally carried out based on the requirements set out by the Department of Museums and Antiquity of Malaysia. According to Dr. Ghafar Ahmad (2004a), a building conservationist in Malaysia, generally there are three main requirements in conservation based on the basic principles of minimum intervention on building structures and fabric. These requirements are also the requirements set by the Department of Museums and Antiquity of Malaysia which are as follows:

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

It can be said that technically all conservation work is always difficult and complicated (Low and Wong, 1997). This is due to the methods and sequence of conservation works as opposed to new construction works. For new building works, the work commences from foundation to the roof. Whilst in building conservation, the work commences from the roof down to the foundation of buildings and the works begin from the exterior buildings to its interior part.

2.0 Special work items in conservation works

In building conservation works, there are some special work items that occur in building conservation works such as dilapidation survey, scientific testing and laboratory studies, temporary roofing and others. These work items are not usually known by quantity surveyors who are not familiar with building conservation works. The problem may arise if inexperienced quantity surveyors miss out to include these special work items in the cost estimate and cause cost overruns in the conservation project. In general, there four main phases in identifying problems associated with heritage buildings before commencing the conservation work on site, namely the reconnaissance survey, dilapidation survey, scientific testing and laboratory studies (Ahmad and Rahman, 2005). These main work items which are only used in building conservation works are essential as it may lead to cost overruns in projects if quantity surveyors miss out to include these items in their cost estimate.

Reconnaissance survey is an initial step for the survey of heritage building, where it involves a general investigation of the building's interior and exterior to gauge the nature and extent of the building's problems, and to identify the panels to be removed for subsequent treatment (Ahmad and Rahman, 2005). The dilapidation survey is usually prepared in anticipation of the work required to rectify any identified building defect. It is also compulsory for the conservation of heritage buildings gazetted by government bodies such as Jabatan Warisan Negara.

The Historical Architectural Building Survey (HABS) is a methodological system of recording building conditions before, during and after conservation work. Other than that, submission of scientific testing and laboratory studies is important in providing additional information to solve heritage building defects. Common scientific testing in building conservation works include archaeological excavation, bricks and roof tiles, local temperature and relative humidity; timber species and strength group, paint colour scheme and tasselled floor tiles (Ahmad and Rahman, 2005).

Apart from the scientific studies, laboratory tests are also carried out on the building materials to identify their existing condition in a building. Common testing that carried out in conservation works in Malaysia includes the brick test to analyse the compressive strength and level of porosity; the timber test to identify timber species, grading and group strength and lime plaster to determine the component elements through X-ray Fluorescene (XRF) analysis.

In conservation projects, there are also some preliminary works before commencement of a project. As usual, in most conservation projects, temporary roofing is required to protect the historical buildings during the conservation of the roof element. If a quantity surveyor is unfamiliar with the conservation works, he or she may miss out some important work items when estimating the cost for the project.

3.0 Problems of current cost estimate method for use in conservation works

Conservation work is considered as one of the most risky, complex and uncertain within the construction industry (Rayers and Mansfield, 2001; Egbu, 1997; Rahmat, 1997). While it may be possible to complete a project within the forecast budget in new-build work, the situation is very different in conservation works (Mansfield, 2009). As the final cost of conservation projects always exceed the anticipated cost (Reyers and Mansfield, 2000), there might be anecdotal evidence showing that the quantity surveyor may have used the wrong estimation method of calculation when dealing with conservation project. In order to prepare a cost estimate for conservation works, firstly a quantity surveyor (QS) has to understand the basic knowledge of conservation work.

However, as the current cost estimating method is designed to estimate the cost in new building works, it has weaknesses when used for building conservation works. This is because the standard list of the elemental cost breakdown provided is commonly used for new building works but not for building conservation works. Typical work items in new building works are roof, floor, wall, and ceiling. While for conservation works, there are specific work items that are not used in new building works such as scientific testing and laboratory studies, and HABS.

However, due to the lack of a standardised format of cost estimate method used for conservation works, quantity surveyors dealing with historic building conservation works frequently have to adapt the standards or format created for estimating new building to suit conservation work. However, the real weakness is that too few quantity surveyors have had the opportunity to participate in conservation works. When dealing with something as sensitive as an individual historic building, a group of buildings contained in a conservation area, or indeed a much larger estate, many practitioners will tend to keep with the familiar and adopt a method which they have used in the past (Davey, 1992). Although the construction methods between new building works and conservation works are different,

quantity surveyors are still adopting the cost estimating method that is used in new building works to prepare the cost estimate for conservation works.

4.0 Methodology of Study

For this research, triangulation is used as the research method, which includes quantitative and qualitative approaches. Data and information are derived from a number of sources such as targeted questionnaire surveys and literature reviews from research done. A six-page questionnaire was sent to fifty (50) construction practitioners including building contractor firms and consultants firms that have been involved in building conservation works, within Malaysia. All the respondents are either directors or senior managers (project manager, senior quantity surveyor, senior supervisor etc.) with an average of over 10 years of construction industry experience.

Special work items used in building conservation works are identified through the literature review and informal discussions with building practitioners. These work items are then included in the questionnaires to be tested in the industry. Data is then presented using pie and bar charts. A descriptive analysis involving the use of weighted mean to rank the work items was done. Weighted mean is used where it calculates the mean of each work item. For this research, the questionnaire survey is adapted to evaluate and rank the inclusion of special work items in estimating work. In this case, the highest number of RI value represents the highest frequency of an item that is not included in cost estimate for building conservation works by quantity surveyors. Enshassi *et al* (2008) in his studies relating to overhead cost in construction projects used equation of relative important index to obtain the results. Also, Ismail (2005) used the Relative Index to identify the current estimating method system used by quantity surveying firms in Malaysia. Hence, the Relative Index is used for this study and the calculation method used for analysing the data is shown below.

$$RI = \frac{\sum_{X=1}^{N} w}{AN}, \ (0 \leq RI \leq 1)$$

In this, w = weighting assigned to each work item by respondent in which 1 being ‘ Yes’ , 2 being ‘Sometimes’, and 3 being ‘ No’.
x = numeric index counting
A = highest weighting used (i.e. 3)
N = total number of respondents.

Dumas (1999) stated that this method is the most commonly used question format for assessing participants' opinions of usability. For the analysis part in this research, descriptive statistics are used to analyse the collected data. This method is used to present quantitative descriptions in which together with simple graphics analysis, they form the basis of virtually every quantitative analysis of data (Trochim, 2006). All the findings are presented in various graphical formats with supporting discussions.

5.0 Results and Discussion

The key aim of the questionnaire is to identify the hidden cost in building conservation works. Based on the literature review, and the preliminary discussions with building practitioners who are involved in building conservation works, a total of 25 work items are identified that are specific only for conservation works and not found in new building works.

The respondents are asked whether these 25 work items are included in the Bills of Quantities or initial cost budget for building conservation projects. In order to determine which work item has the highest chance of not being included in the Bills of Quantities, the answers given are analysed using R.I. The respondents are given three options to answer which are ‘Yes’, No’ and “Sometimes’. Relative Index (RI) is used for ranking and developing metrics for each work item. In this case the weighting assigned to each work item by the respondent in which 1 being ‘ Yes’ , 2 being ‘Sometimes’, and 3 being ‘ No’. The lowest number of RI value represents the highest frequency of an item that is not included in cost estimate for building conservation works by quantity surveyors. Table 1.1 presents the special work items within defined categories and they are ranked according to RI values.

Table 1.1 Relative Index of work item & ranking

No	Special work items	Scale			RI	Ranking
		1	2	3		
1	'Carbonation test'		12	4	0.92	1
2	'NIPGAT test'		10	6	0.88	2
3	'Petrography test'		9	7	0.85	3
4	'Windsor probe test'	3	10	3	0.81	4
5	'Covermeter survey'		7	9	0.81	4
6	'Half cell survey'		7	9	0.81	4
7	'Laboratory organic plat and microbiology analysis'	1	7	8	0.79	5
8	'X-Ray fluorescence test (XRF)'	3	6	7	0.73	6
9	'Compressive test'	4	7	5	0.73	6
10	Local temperature and relative humidity test	5	7	4	0.71	7
11	'Core test'	3	6	6	0.69	8
12	'X-Ray diffraction test (XRD)'	6	6	4	0.67	9
13	Schmidt hammer rebound test on new wall plaster	4	4	8	0.67	9
14	'Mackintosh probe test'	5	5	6	0.67	9
15	'Chemical test'	7	5	4	0.63	10
16	'Salt content level test'	7	4	5	0.60	11
17	Tasselled floor tiles test	9	5	2	0.58	12
18	Archaeological Excavation	7	3	6	0.58	12
19	Preparation of Scaled Photograph	11	5		0.54	13
20	Historical Architectural Building Survey (HABS)	11	3	2	0.50	14
21	Paint colour scheme test	11	2	3	0.48	15
22	Bricks and roof tiles test	11	2	3	0.48	15
23	Timber species and strength group test	13	1	2	0.42	16
24	Temporary Roofing	14	1	1	0.40	17
25	Scaffolding	15	1		0.38	18

From the findings, these work items range in between 0.38 and 0.81 of RI values where 40% of work items have more than 0.70 RI value. The rest of the work items are in between 0.38 and 0.69 RI value. The higher the RI value, the more frequent the inclusion of work items by quantity surveyors when estimating cost for building conservation works. As shown in Table 1.1, the result appears to be that some specific work items are not frequently included by respondents in estimating the building conservation project and these may account to hidden cost in project. For this research, these 25 work items are categorised into four groups: 'Research and Documentation', 'Scientific Studies', 'Laboratory Tests' and 'Temporary Works'. This grouping is formed to analyse and to elaborate on the work items according to their functions in conservation works.

5.1 Research and Documentation

Table 1.2 Ranking of work items in 'Research and Documentation'

No	Special work items	RI	Rank	Overall Ranking
1	Preparation of Scaled Photograph	0.54	1	13
2	Historical Architectural Building Survey (HABS)	0.50	2	14

Table 1.2 shows the special work items under the category of 'Research and Documentation' that are usually encountered in building conservation works. The top ranked item within this category is 'Preparation of Scaled Photograph' with RI value of 0.54 but its overall ranking is thirteenth. Historical Architectural Building Survey (HABS) ranks fourteen in the overall ranking with the RI of 0.50. Amongst the 15 respondents, majority of the respondents agreed that inclusion of HABS is vital in the conservation projects they have undertaken. It is considered fundamental in commencing the conservation works of heritage buildings. In Malaysia or elsewhere, the HABS is often required by some clients where it is prepared in anticipation of the work required to rectify any identified building defect. The documentation requires a building analysis report, illustrated with drawings,

photographs, and other relevant details. Furthermore, at every stage including the process of before, during, and after the conservation works must be recorded in a form of photography or report.

'Preparation of Scaled Photograph' is a type of recording where photographs are taken inside or around the historical buildings and those pictures are recorded using Datum point / Datum line. This type of research has been used widely by conservationist architects or contractors when recording the site before conserving for future reference. In addition, additional work items under this category have also been suggested by respondents, which include Video Recording, Method of Statement and Dilapidation Survey Report.

5.2 Scientific Studies

The conservation of building requires scientific studies and tests to be carried out prior to any commencement of work on site. Results from the scientific studies and laboratory tests, presented in technical reports and information sheets, served as inputs in decision making in restoration works, particularly in selecting building materials, identifying appropriate methods and techniques of repair; and in structural modifications (Ahmad, 2004b). As shown in Table 1.3, here is a list of testing for building conservation works.

Table 1.3 Special work items in 'Scientific Studies'

No	Special work items	RI	Rank	Overall Ranking
1	'NIPGAT test'	0.88	1	2
2	Local temperature and relative humidity test	0.71	2	7
3	'Mackintosh probe test'	0.67	3	9
4	Schmidt hammer rebound test on new wall plaster	0.67	3	9
5	Archaeological Excavation	0.58	4	12
6	Tasselled floor tiles test	0.58	4	12
7	Bricks and roof tiles test	0.48	5	15
8	Paint colour scheme test	0.48	5	15
9	Timber species and strength group test	0.42	6	16

Nine special work items are included in this group, as shown in Table 1.3. Their Relative Index (RI) values range in between 0.42 and 0.88. The higher the RI value of work items, the higher the tendency that quantity surveyors and contractors not include these items when estimating cost for building conservation projects. The four top ranked special work items in this group include ' NIPGAT test' , 'Local temperature and relative humidity test', 'Mackintosh probe test', and 'Schmidt hammer rebound test on new wall plaster'. 'NIPGAT test' ranks top in this category with RI value of 0.88, and ranks second in overall ranking. The high value RI of 'NIPGAT test' appears to be that respondents may not be familiar to this test which it is not commonly used for building conservation projects in Malaysia. According to literature study and data collected, NIPGAT or 'neutron-induced prompt gamma-ray technique' is a type of testing in order to determine the location of water and soluble salt in building materials such as mortar, brick walls and pillars in the historic building (Taha, n.a.). If quantity surveyors are not aware of the need to include this item in their cost estimate, and when contractors encounter building defects on site during the conservation works which require additional remedial work. If such works are needed on site, this will be additional costs to the budget and will subsequently contribute to cost overruns in this project.

'Local temperature and relative humidity test' ranks 2nd with RI value of 0.71, placing in overall ranking of seventh. This test is used to measure and keep track of the local temperature and percentage relative humidity at site. For the 'Schmidt hammer rebound test on new wall plaster' test, it is carried out to determine the compressive strengths between the new and the old plaster walls (Ahmad, 2004b). While for the 'Mackintosh probe test', this test is a simple and economic testing method to gather preliminary data on sub surface condition such as depth of water table, depth of peat soil and bearing capacity of the soil (Islam, 2008). As these testing are very specific and technically used for building conservation works, quantity surveyors are suggested to work together with other building consultants in order to estimate the cost for building conservation works.

The lower ranking of work items in a group which include 'Timber species and strength group test', 'Paint colour scheme test' and 'Bricks and roof tiles test ' with an RI range of 0.42 and 0.48 indicates that these tests are common and widely used by the conservationist when conserving historical buildings in Malaysia. The 'Paint colour scheme test' item is an identification of the original building colours entailing the use of new paintwork including colour and the type of paint (Ahmad, 2004b). In building conservation works, the conservationist conducts this test in order to identify the original colour of buildings in terms of its type of paint or layers of colours. This item ranks fifth in this group together with 'Bricks and roof tiles test', with an RI values of 0.48.

Although the above testings are essential to carry out to identify building defects prior to commencement of work on site, not all the conservation of historic buildings in Malaysia follow it. This is due to limited building conservation experts in Malaysia where occasionally foreign conservations experts are invited to investigate the building defects of certain important historical buildings in Malaysia. Generally, government funded conservation projects usually conduct several scientific testing on site while private owners do not often follow that, except for a few simple and not costly testing such as 'Paint colour scheme test'. The high cost of scientific studies and laboratory testing is one of the main reasons owners avoid carrying out the tests and presently only the government is able to afford the cost for such tests. Moreover, government buildings are required to follow the conservation guidelines hence those tests are compulsory in the process of conserving the building back to the original state.

When there is less or no scientific testing conducted prior to the commencement of conservation works, hence there may be some hidden building defects that are unable to be determined at the early stage of work. When the work begins on site, a wrong construction method may destroy the building's elements and cause rework in conservation works. As such, these remedial works would require additional cost such as cost on materials, cost on hiring of equipment and it could cause cost overruns in the project later.

5.3 Laboratory Tests

Conducting both scientific studies and laboratory tests are important aspects in the restoration as it provides vital information in identifying and solving building defects and problems (Ahmad, 2006). Table 1.4 lists the special work items under laboratory tests as follows:

Table 1.4 Ranking of work items in 'Laboratory Tests'

No	Special work items	RI	Rank	Overall Ranking
1	'Carbonation test'	0.92	1	1
2	'Petrography test'	0.85	2	3
3	'Half cell survey'	0.81	3	4
4	'Covermeter survey'	0.81	3	4
5	'Windsor probe test'	0.81	3	4
6	'Laboratory organic plat and microbiology analysis'	0.79	4	5
7	'Compressive test'	0.73	5	6
8	'X-Ray fluorescence test (XRF)'	0.73	5	6
9	'Core test'	0.69	6	8
10	'X-Ray diffraction test (XRD)'	0.67	7	9
11	'Chemical test'	0.63	8	10
12	'Salt content level test'	0.60	9	11

This category consists of 12 work items, as shown Table 1.4. Their RI values range between 0.60 and 0.92. This indicates that the majority of the items in this group have a relatively lower degree of inclusion in the cost estimate for building conservation works. On top of this category is 'Carbonation Test' with an RI value of 0.92, placing it top in the overall ranking as well. This test is used to determine the level of carbonation of construction materials such as bricks and wood, hence giving an indication of the present risk of reinforcement corrosion. This preliminary

technical survey on the building structure is important before conservation work is commenced. However, it is found that not many building practitioners include this testing for the conservation of historical buildings in Malaysia. 'Petrography test' is ranked second with an RI value of 0.85, placing it 3rd in overall ranking. It is used to identify components, colour, average size, range size, shape and details of the percentage of construction materials such as floor tiles. In the event that a defect shows up, it can be evaluated early in the construction process, and corrections can be made (Paster, 2003).

There are three work items ranked third in this group with RI values of 0.81, namely, the 'Windsor probe test', 'Covermeter survey' and 'Half cell survey'. They are ranked fourth overall. The 'Half cell survey' is used to assess the durability of reinforced concrete members where reinforcement corrosion is suspected. For example, it can be used to determine the level of rusting that has occurred on metals such as steel tubes and steel beams. The 'Covermeter survey', is used to determine the composition for building materials made from metals such as steel tube and steel beams while the 'Windsor probe test' is used to determine the level of strength of bricks. These three tests are non-destructive testing and it is recommended to conduct these tests in order to keep track of the existing conditions of the building structures. Otherwise, when the building defects are only found during the work on site, it would lead to cost overruns in the project later.

'Laboratory organic plat and microbiology analysis' is a test of identifying the types of plants that grow and live on the building elements such as the walls, pillars, floors and roof. This work item ranks fourth in this group, with an RI value of 0.79. Other items including 'Compressive test' and 'X-Ray fluorescence test (XRF)' rank fifth in this group, with overall ranking of sixth overall. The 'Compressive test' is used to determine the level of compression strength of bricks and it is commonly used in building conservation works in Malaysia. While for 'X-Ray fluorescence test (XRF)', it is used to identify the composition and ratio of materials that forms the connection between mortar and brick on the wall. 'Salt content level test' ranks the last with an RI value of 0.60, placing it eleventh on the overall scale. Salt attack has been considered as one of the major building defects found in heritage buildings (Ahmad, 2004b). Hence, the test needs to be carried out in order to detect the salt level content in brick walls for treatment purposes.

From the results, all testing in this group have higher RI values compared to testing in other groups. This appears to be that most respondents are not aware of the need for the inclusion of these items in cost estimate for this particular type of project. It shows that it is not a common practice in industry to conduct all the testing listed in Table 1.4 as it depends on the type of project. For government buildings, building practitioners are required to follow the conservation guidelines and so testing must be carried out prior to conservation works on site. For non-government buildings such as shop houses, a majority of respondents include only some testing listed in Table 1.4, prior to commencement of work on site. As these tests are important and need to be carried out for conservation projects, quantity surveyors need to include these items in their cost estimate, so that the contractors understand their scope of work, and thus reducing the risk of cost overruns occuring at a later stage.

5.4 Temporary Works

Table 1.5: Ranking of work items in 'Temporary Works'

No	Special work items	RI	Rank	Overall Ranking
1	Temporary Roofing	0.40	1	17
2	Scaffolding	0.38	2	18

Only two work items are included in this category, 'Temporary Roofing' and 'Scaffolding'. 'Temporary Roofing' is ranked the first in this category and 17th in overall ranking while 'Scaffolding' is ranked last in this category and also in overall ranking. The lower RI values of these items show that a majority of the respondents include these items in their cost estimate for building conservation works. 'Temporary Roofing' is vital for the use of protecting the elements inside the building from outside factors such as rainwater or whatever that could cause damage to the elements in the building during conservation works. It is an important and common work item that is usually found only in building conservation work. Other than that, there are also additional special work items suggested by the

respondents to be included in this category such as 'Temporary shutting' and 'Shoring of facade' in which these items are also used to retain the historic facade of the buildings.

6.0 Summary and Conclusion

The basis of the cost estimate of building conservation works should comprise of all work items especially those work items that are specific to building conservation works. However, due to the lack of knowledge in conservation work, the cost estimate of the quantity surveyor has many missing costs as verified by the conservationist in this country. Thus, the research attempts to identify these hidden costs. Based on the respondents' comments and suggestions, a total of 32 work items which are commonly encountered in building conservation works are identified. These work items are grouped into four main categories such as 'Research and Documentation', 'Scientific Studies', 'Laboratory Tests', and 'Temporary Works', according to their scope of work. In addition, this research recommends that quantity surveyors should be aware of the work items since the preliminary stage of conservation works is when the majority of the work items are carried out, prior to commencement of work on site. Table 1.6 lists all the work items that are frequently used in building conservation works.

Table 1.6 Special work items used in building conservation work

No	Categories	Work Items
1	Research and Documentation	a) Historical Architectural Building Survey (HABS) b) Preparation of Scaled Photograph c) Video d) Method of statement e) Dilapidation Survey Report
2	Scientific Studies	a) Archaeological Excavation b) Bricks and roof tiles test c) Local temperature and relative humidity test d) Paint colour scheme test e) Tasselled floor tiles test f) Timber species and strength group test g) 'Mackintosh probe test' h) 'NIPGAT test' i) Schmidt hammer rebound test on new wall plaster. j) Damp Rising Test
3	Laboratory Tests	a) 'Salt content level test' b) 'Chemical test' c) 'Compressive test' d) 'Windsor probe test' e) 'Core test' f) 'X-Ray fluorescence test (XRF)' g) 'X-Ray diffraction test (XRD)' h) 'Petrografi test' i) 'Carbonation test' j) 'Timber strength test' k) 'Covermeter survey' l) 'Half cell survey' m) 'Laboratory organic plat and microbiology analysis'
4	Temporary Works	a) Scaffolding b) Temporary Roofing c) Temporary shutting d) Shoring of façade

In summary, all special work items listed in Table 1.6 which are grouped under four main categories are important and commonly found in building conservation works. However, due to unfamiliarity of conservation works by quantity surveyors, they may overlook these work items when estimating costs for this type of projects. Furthermore, the complexity and uncertainty of conservation works where some building defects may only be encountered during conservation work on site, may force cost overruns occur in project. Thus, quantity surveyors may find it difficult to anticipate cost for building conservation works as these costs is hidden at the early stages of work. Although these items are not necessary to be included in all the conservation projects, in order to estimate the cost accurately, quantity surveyors should obtain confirmation from conservationists what testing is to be included according to different types of conservation projects. With this research, where special work items are determined and identified, and therefore it is suggested that building practitioners include these items in their cost estimate for building conservation projects in future.

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