

CLASSIFICATION OF WORK ITEMS FOR BUILDING CONSERVATION WORK

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ABSTRACT

Although conservation of heritage buildings has been ongoing for many years in this country, costing information and documents pertaining to conservation work is still lacking. The restoration technique of conservation works which is different from new building works has not allowed the Quantity Surveyor (QS) to use the current analysis format to prepare the cost estimation for building conservation projects. Study has shown that QS essentially modify or adapt information or standards from new construction works to be used for conservation works. While this method is not totally incorrect, there is the risk of missing out important cost elements that are specific for conservation works and not found in new building works. As such, a study was conducted to identify the main works items in conservation works for heritage buildings. A total of 16 conservation projects were sampled and their Bills of Quantities was analysed to determine the work items that are frequently recurring in conservation works. From the analyses, it was found that works to partitions, doors and ironmongeries are frequent work items in conservation projects. This is followed by roof finishes and rainwater goods, floor finishes, external walls, doors and windows. The same analysis was also performed on preliminaries items to identify the common items. Preliminaries items found to be prevalent could be grouped into two groups, i.e. general preliminaries items such as temporary works and conservation related items such as preparation of HABS report, scientific testing and colour scheme testing.

Keywords: Classification, Conservation, Heritage Buildings, Work Items

1. BACKGROUND

In conservation works, the costs to conserve heritage building are determined by the range of defective works thus work items for conservation works are usually different from new works. Although cost estimating for conservation works differs from new building works, the general principles are valid for both cases. As conservation by their nature often involve work that cannot be accurately predetermined in terms of specification, extent, duration or cost (Reyers and Mansfield, 2000), QS needs to be alert of the special work items that are only encountered in conservation works. Therefore, it is important to have a standard format of cost for conservation work to act as a checklist ensuring all necessary cost are included in a cost estimate. It is also a useful tool for compiling historical cost of conservation projects for reference purposes.

2. COST ANALYSES

A cost analysis shows how the costs of a building are distributed over building elements and groups (Seeley, 1996). The format of cost analysis commonly used is the elemental system which a building is analyse by elements or groups to show the cost significant of different parts of a building. It is used to provide the preliminary cost budget and also to form the basis of cost control of a building. According to

the Royal Institute of Chartered Surveyors (RICS) in United Kingdom, the term Elemental Cost Analysis (ECA) is defined as “*a systematic breakdown of the cost of building to a client into various elements in term which are meaningful to both client and the member of the design team*”. This term could be explained by which the purpose of preparing a cost analysis for a building project is an attempt to reveal the cost relationship between the various sections of a project, and also to allow for some comparability with other schemes (Ashworth, 1988).

ECA is considered as one of the useful cost estimation techniques in construction which is widely accepted worldwide. It provides the same function with standardise work section in a building independent of quantity, work specification and rate thus allows meaningful comparisons to be made (Seeley, 1996). It is required during the inception stage of the design process in order to provide clients with an indication of possible costs associated with a proposed construction project. They are also required at the various levels of detail as the project proceeds through the design and construction stages (Ashworth, 1988). Hence, the cost data to be used during cost estimation should be reliable and updated so that the cost estimation can reflect the reality (Elcin and Yaman, 2005).

Bills of Quantities (BQ) is a major source of cost information (Ferry, 1999) which includes the detailed breakdown of all the elements used in construction works. Hence, it is useful for preparing ECA. For preparation of ECA, the cost is computed on a floor area basis with the overall building unit cost broken down into appropriate elements and sub-elements (Seeley, 1996). In this detailed aggregation of work items, it is hence possible to make cost adjustment for a newly proposed project. Overall, this cost analysis could be used to assist QS in cost planning and enables the design team to control effectively the cost at the early design stages. It could also be used to predict the project cost throughout the construction phase for cost control purpose.

3. COMPARISON BETWEEN NEW BUILDING WORKS & CONSERVATION WORKS

Technically, all restoration work is always difficult and complicated (Low and Wong, 1997). In conservation, restoration works begins from the highest structure of building, which is the roof followed by ceiling, floors, walls and columns, and to the foundation works. The restoration works could also commence from the exterior of the building to the interior. In other words, the sequence of work items for conservation works is different from new building works as it is a reverse sequence of the new build works.

There are some special considerations to note in preparing the cost estimation for building conservation works. They are archaeological excavation, scientific testing and analysis which are not encountered in new building works. For conservation works, the structural works and finishes for a building like floor, ceiling, and roofs are categorised together as compared to new building works where these works are separated into structural and finishes category respectively. This is because in conservation works, it is easier and convenient for the contractor to appoint specialists to restore specific parts of the building as all works in the damaged parts are usually interrelated to each other.

4. METHODOLOGY

A total of sixteen buildings which are categorized as heritage building by the Penang Municipal Council (MPPP) were selected for this research. The selection of the projects is based on one important criterion which is the availability of a complete BQ. The reason for this is because information from the BQ is critical for this study to identify the work items pertinent to building conservation works. The selected buildings consist of shop houses, commercial buildings, religious buildings, private houses, and monuments. Descriptive statistics were used to analyse the data extracted from the BQ of each project. The analyses first attempt to identify the work items that frequently occur in conservation projects. The work items are duly identified and ranked according to the frequency used in each of the 16 project. Table 1 lists out the sixteen (16) projects that were used as research projects. Each building is classified according to the different building types.

Table 1: List of project samples for Conservation Works

No	Public/ Private	Building Category
A	Private	Commercial
B	Private	Commercial
C	Private	Private House
D	Private	Monument
E	Private	Commercial
F	Public	Religious
G	Public	Monument
H	Public	Religious
I	Private	Shop Houses
J	Private	Religious
K	Private	Commercial
L	Public	Monument
M	Public	Monument
N	Public	Monument
O	Private	Commercial
P	Public	Monument

From the 16 projects, 40 work items which are frequently used in conservation works are identified and listed in Table 2 below. Further analysis is then performed on work item that has a frequency of more than 50%. These cost items are then grouped according to the broader work elements to enable the study to come out with a proposed cost analysis format specifically catered to building conservation works.

Table 2: Ranking of Work Items in Conservation Works

No	Work Items	F	No	Work Items	f
1	Partitions, Internal Doors	16	21	Upper Floor	7
2	Ironmongeries	16	22	Anti- Termite Treatment	7
3	Roof Finishes & Rainwater Goods	15	23	Substructure	7
4	Floor Finishes	15	24	Structural Steelwork	6
5	External Walls, Doors, Windows	15	25	Furniture & Fittings	5
6	Internal Wall Finishes	14	26	Walkways , Driveways, Car Parks , etc	5
7	Ceiling and Finishes	14	27	Lighting System	5
8	Roof Construction	13	28	Frame	5
9	External Wall Finishes	13	29	Waterproofing	4
10	Staircase Finishes and Balustrades	13	30	Security & Sound System	4
11	Painting	13	31	Fencing & Gate	4
12	Demolitions / Dismantling Works	12	32	Archaeology Excavation	3
13	Plumbing & Sanitary Installation	11	33	Surface Water Drains, Sump & Culverts	3
14	Scientific Testing and Analysis	11	34	Water & Sewer Mains, Foal Drainage, Manholes	3
15	Decorations (Cornice)	11	35	Adjoining Property Wall / Boundary	3
16	Timber Roof Trusses	10	36	Pavers	3
17	Staircase Construction	10	37	Flooring	3
18	Sundries	8	38	Fire Fighting	3
19	Electrical System Installation	8	39	Fence Wall	2
20	Roof Covering	7	40	Landscaping	2

* f= Frequency

5. DISCUSSIONS

In Figure 1, a total of ten (10) most frequently used work elements are identified and shown in the chart. These work items are further analysed based on their cost significance and the reasons for its frequent use in conservation projects.

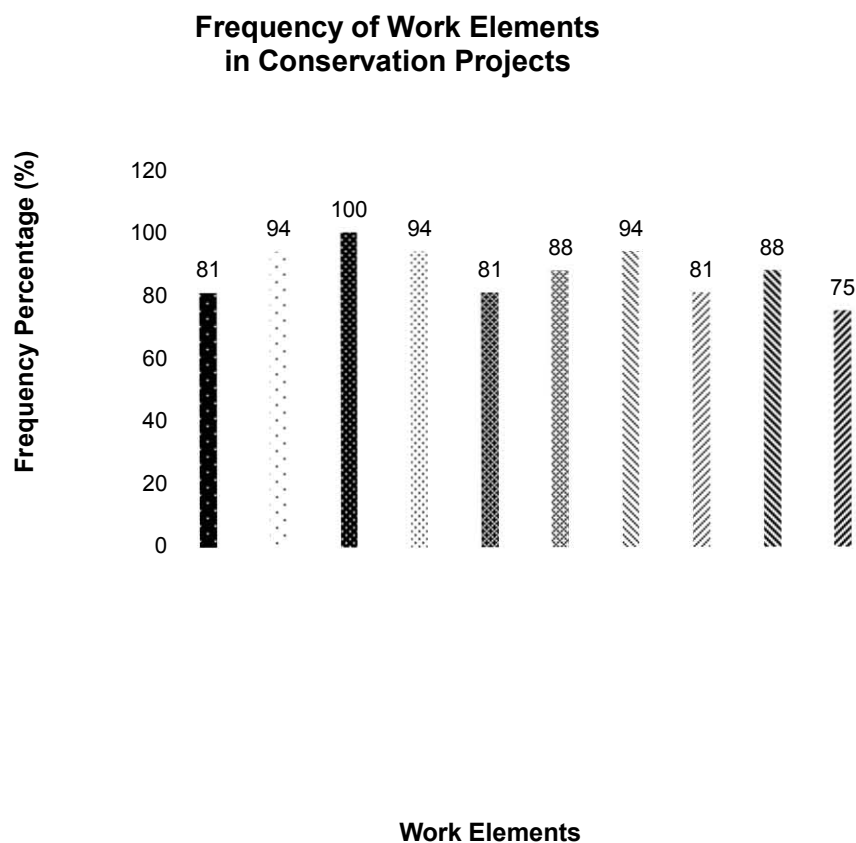


Figure 1: Frequency of Work Elements in Conservation Projects

Figure 1 shows that '*Partition, Internal Doors and Ironmongeries*' occur in all 16 projects. Three other elements which are '*Roof Finishes & Rainwater Goods*', '*Floor Finishes*', and '*External Walls, Doors, Windows*' are the second most occurring elements (94%). '*Internal Wall Finishes*' and '*Ceiling and Finishes*' are the third most common work elements that are found in the sampled projects, having a frequency percentage of 88% for both items. In thirteen (13) out of 16 projects, work elements such as '*Roof Construction*', '*Staircase Finishes & Balustrades*' and '*External Wall Finishes*' are found to have a frequency percentage of 81%. A similarity could be seen among ten (10) items found in conservation works with new building works. The top ten major work elements identified in this study is not only applicable for building conservation works but also for new building works.

Common structural repairs of work items such as staircase, wall and columns, are found to have a higher frequency among all projects. As wall is connected to most other elements such as column and beam, ceiling, or floor, the repairs of other parts in the building may also cause some cracking to the wall, thus necessitating remedial works to be applied to the wall during restoration works. The same reason could also apply to the floor element. Usually, the staircase and railings are found to be badly decayed or damaged and need to be replaced with a new one. Hence, this work item is also listed in the top ten most frequent works encountered in conservation projects, with a frequency of 63%. Likewise, restoration of

roof and its finishes are also found to be in need of repair in all projects. Roof is always badly affected due to the exposure to weather for prolong period.

The analyses show that demolition work is often included in conservation works, with a frequency of 75%. Although the basic principle of minimum intervention underpins all conservation work, it cannot be neglected that in certain circumstances, removing the deteriorated work items is a must. In some projects, it is also found that external works contributed a small portion in the conservation works cost but data collected did not clearly present the distribution of work items for the external works, thus the data did not allow for further analysis for this particular work element. The restoration of historical or old buildings often includes the installation of new electrical services including lighting installation and fire alarm systems to comply with the current safety regulations. It is shown that close to half of the 16 projects included works of electrical and lighting installation, as well as fire fighting for safety purpose.

The item on 'Scientific Testing and Analysis' could also be found in most conservation projects. This is due to the requirement set by the local authorities that required investigation of defective works in a building before starting work on restoring it. The study found that 11 out of 16 projects had conducted scientific testing on the buildings to determine the defective works. These tests include 'Anti-termite', 'Salt Contamination & Rising Damp', 'Timber test', 'HABS Dilapidation Survey' and 'XRF test'. Other tests may be directed if the conservationist felt that there is a need for it. It must be clearly understood that the percentages shown above represents work elements that are frequently occurred in conservation projects and it does not depict the cost significant of the work element in conservation project.

5.1 Preliminaries Work Items

For preliminary work items, it is discovered that they are either allocated as independent work item or were distributed among other elements in BQ. The study found that there is a lack of data for preliminary work items in some projects, due to simplified BQ format. Thus, for the analysis on preliminaries, only five (5) out of the 16 projects have complete preliminary work section data and are available for further analysis.

From the analysis on preliminaries, temporary works appeared to be the most frequently used among all preliminary work items. The temporary works include '*Temporary Water & Electricity Supplies*', '*Temporary Telephone*', '*General Scaffolding & Staging Temporary*' and '*Temporarily Roads*' and '*Temporary Lighting*'. These temporary works are required to ensure the safety and stability of the building before construction work begins. Progress Photographs & Reports is also essential for conservation works in order to provide proper documentation of the restoration works. Scientific testing report of the proposed restored building is required to determine the level of defective works and to provide suggestion of remedial works to repair those decayed items. Hence, four (4) out of five (5) projects had included this item in the preliminary section. Overall, it could be concluded that the preliminary items for conservation works are similar with new building works except for some additional items which are only applicable to conservation project. Those new items include HABS report preparation, scientific testing and report and colour scheme testing.

5.2 Grouping of Cost Significant Work Items

In order to determine a new elemental format for conservation works, all the work items identified earlier will be grouped under its relevant elemental category. From the 40 work items identified earlier, those with the same functional use would be grouped under the same component. Table 3 below shows the grouping of 40 work items according to their functional use in a building. Fourteen (14) major groups were formed from the rearrangement of the work items into the relevant component.

Table 3: Grouping of Work Items

No	Work Items	Group Component
1	Demolitions / Dismantling Works	Demolition Works
2	Roof Covering	Roofing
3	Roof Construction	
4	Timber Roof Trusses	
5	Roof Finishes & Rainwater Goods	
6	Flooring Construction	Flooring
7	Floor Finishes	
8	Ceiling and Finishes	Ceiling
9	External Wall Finishes	External Wall, Doors & Windows
10	External Walls, Doors, Windows	
11	Fence Wall	
12	Painting	
13	Partitions, Doors	Internal Wall & Doors
14	Internal Wall Finishes	
15	Ironmongeries	
16	Decorations	
17	Staircase Construction	Staircase
18	Staircase Finishes and Balustrades	
19	Structural Steelwork	Structural Works
20	Upper Floor	
21	Frame	
22	Substructure	
23	Sundries	Sundries
24	Furniture & Fittings	Furniture & Fittings
25	Electrical System	M& E Works
26	Lighting System	
27	Security & Sound System	External Works
28	Walkways , Driveways, Car Parks , etc	
29	Pavers	
30	Fencing & Gate	
31	Surface Water Drains, Sump & Culverts	
32	Water & Sewer Mains, Foal Drainage,	
33	Manholes	
34	Fire Fighting	
35	Adjoining Property Wall / Boundary	
	Landscaping	
36	Plumbing & Sanitary Installation	Plumbing & Sanitary Installation
37	Archaeology Excavation	Conservation Treatment
38	Scientific Testing and Analysis	
39	Anti- Termite Treatment	
40	Waterproofing	

As showed in Table 3 above, the grouping of work items into the relevant component group is based on the similar functional use among the work items. As the works for new build and restoration are quite similar with some exception, the grouping of items for conservation work is also rather similar with the grouping for new building works. Having said that, the study also found that there are some grouping which are not similar with new building works. For example, 'External Wall, Doors and Windows' is listed as an item due to special consideration for building conservation works where the restoration works for these three elements come together in a package. Likewise, this reason is also applicable to the item of

‘Internal Wall and Doors’ where the deterioration of walls also affects its surrounding, such as doors and windows. Thus, the combination of these three elements as a group item is suggested in order to reduce the number of work items to enable easier cost analysis of the total cost of conservation works.

In the earlier analysis, external works, furniture and fittings, structural works, and conservation treatment are found to be infrequent items in the 16 projects. However, due to the costs significant of these items, a separate group for each of these works is formed. From the above analysis, the study proposes a format for cost estimate and analysis based on an elemental form for conservation works. The proposed format is explained in the section below.

6. RECOMMENDATION

Table 4 shows the proposed elemental cost analysis (ECA) format for conservation works. It is recommended based on the literature review findings and the analysis conducted. In addition, the cost significant works items are also used to produce the proposed format. The recommended ECA format for building conservation works consists of six main portions namely: Preliminaries, Research and Documentation, Dismantlement Works, Temporary Works, Conservation & Restoration Works, and New Building Works. It is designed based on the sequence of works for conservation work and also includes cost significant work items for restoration works in which they are distributed based on same functional use of the items.

Table 4: Recommended Cost Analysis Format for Conservation Works

1. PRELIMINARIES
2. RESEARCH AND DOCUMENTATION 2A. Scientific/ Chemical Analysis 2B. Preparation of Scaled Photograph 2C. Preparation of ‘Historical Architectural Building Survey (HABS)’ 2D. Colour Scheme Testing 2E. Preparation of Dilapidation Survey Report 2F. Video Recordings 2G. ‘Anti-Termite’ Works
3. DISMANTLEMENT WORKS 3A. Demolition Works
4. TEMPORARY WORKS 4A. Scaffolding 4B. Temporary Roofing 4C. Others associated work
5. RESTORATION WORKS 5A. Roof and Rainwater Goods 5B. Floor Structure and Finishes 5C. External Envelope 5D. Internal Walls and Column and Finishes 5E. Ceiling and Finishes 5F. Staircase and Balustrade 5G. Doors and Windows 5H. Structural Works 5I. Interior Fixtures and Fittings 5J. Decoration Element 5K. Treatment of Damp penetration, Timber Decay and associated work 5L. Services
6. NEW BUILDING WORKS New Additional Works

In conservation works, the restoration works begins from roof down to the foundation works. Although this is not a standard guideline that the work for conservation should be measured from the top of the roof

to its foundation, it is suggested that QS should follow the work items sequence as listed in Table IV, for measurement and cost estimation of conservation projects. Hence, for the Conservation & Restoration Works part, 12 work items are listed in accordance with the sequence of conservation works which are Work Items 5A to 5L.

From the earlier analysis, temporary works are common work items encountered in conservation works and are grouped separately from other works. Demolition work is one the major work items for conservation works and it cannot be allocated together with other work items due to its different nature, therefore it is listed as an independent group. Scientific testing and building recording are listed under 'Research and Documentation'. Conservation works should always be accompanied by a detailed description of the building's condition before, during and after restoration works. Scientific testing which is carried out by conservators or architects on defective works and the remedial works undertaken shall be listed under Research and Documentation work group as well. The HABS documentation shall contain photographs taken before, during and after the conservation works and record the conservation works in every stages. New building works in this proposed format are defined as additional new items installed to a restored building. Preliminary group items include any preliminary works before the restoration works and it does not include scientific testing and temporary works as those items are placed in another main group items listed in Table 4.

7. CONCLUSION

Due to the limitations in the existing ECA format, there is a need for a new format of elemental cost analysis specifically for conservation works. The current analysis format adopted by QS may not be suitable to be used in conservation works due to incomplete work items that are specific for conservation works. Thus this study has attempted to identify all the work items for conservation works and then to suggest a new classification of work items and recommends a new breakdown of ECA for building conservation. Reapportion of the work items identified to an appropriate cost component has been done to form a new grouping on a basis of same functional work items being grouped together under main groups. The inclusion of new work items and exclusion of some common work items are based on the frequency of the work items and also the cost significance encountered in conservation works. The final outcome of this research is a new standard form of analysis formulated and recommended to the building industry for cost estimation or cost planning purposes for building conservation works.

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