

## **The Influencing Factors of an Effective Maintenance Programme for Heritage Buildings in Batu Pahat, Johor**

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**Abstract:** Numerous heritage buildings were in bad condition, with visible signs of significant deficiencies, posing a threat to their survival because heritage building, leading to poor maintenance and management practices, which sooner or later lead to the degradation of all these buildings. Therefore, the aim of this study is to find the influence factor in effective maintenance programme and the criteria of effective maintenance programme. The method that has been used in this study is to use a qualitative method that is by collecting information through questionnaires. The Likert scale method was used in preparing the questionnaire. The data obtained were analyzed using the averaging index method to obtain the factors and criteria most agreed by all respondents. As a result of the successful data analysis obtained, three factors which is procedure of work, skilled workers and organizational management and criteria of an effective maintenance program were obtained in this study. Through the results of the study obtained, it is hoped that the factors and criteria that have been found can emphasize by the parties involved in maintaining heritage buildings from the aspect of culture and structure. All maintenance issues that arise should be investigated first in order to identify the elements that contribute to the issues.

**Keywords:** Heritage Building, Maintenance, Influencing Factors, Conservation

### **1. Introduction**

Malaysia is brimming with valuable heritage buildings. According to the findings of a 1992 research by the National Museum on the inventory of Malaysian cultural buildings, about 35,000 pre-war structures in 265 cities all over the country should indeed be protected [1]. However, due to building degradation issues, the majority of these heritage buildings are not as well and are in poor condition. It's even more regrettable that these heritage buildings are in danger of even being

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demolished due to the original owners' mismanagement and a lack of public awareness for heritage conservation [1].

Despite the fact that Malaysia has such a large number of history buildings throughout the country, there is a lack of awareness about heritage building conservation practises [2]. Due to fast modernized growth, numerous pre-colonial structures have been removed for modern development [3], public attitudes regarding particular heritage building preservation have continued to stay bleak [4].

The objective of this study was to find three main factors that can influence effective program maintenance and three criteria of effective program maintenance. heritage building in Batu Pahat, Johor. The main objectives shall be achieved at the end of the study as follows: (a) To identify the factors that influence an effective maintenance programme for heritage buildings, (b) To determine the criteria of effective maintenance programme of heritage building in Batu Pahat, Johor.

## 2. Literature Review

Heritage building conservation is crucial not only about making the building usable, but mostly for preserving the structure's distinctiveness throughout time. Heritage buildings, on the other hand, will undoubtedly deteriorate over time, lowering the quality of the design, services, and upkeep [5]. Systematic and schedule maintenance work is sometimes overlooked as part of conservation efforts, owing to a misconception about the need for such work after restoration [6]. Above everything else, it is critical that efforts be made to increase stakeholder and public awareness about heritage preservation [7].

### 2.1 Building Maintenance

Building maintenance aims at keeping the quality of the structure fabric, as well as its facilities and surrounds, as well as maintaining the recognized standard and the utility and worth of the building. The process of installing, renovating, improving, and repairing existing facilities is an example of infrastructure maintenance work [8]. The goals of building maintenance were to ensure that the buildings and their related services were in a safe condition, that the buildings are fit for use, that the building's condition met all standard requirements, and that the required maintenance work was carried out in order to preserve the physical assets' worth and the building's quality [9].

The building conservation method begins with roof restoration and progresses to other parts of the structure's features. The procedure is carried out from the top to the bottom of the structures. The following are some examples of building conservation projects [10]:

1. Removal of filth, fungus, and hazardous growth from the wall and column.
2. Roof tile disassembly and salvage storage
3. Before beginning restoration work, protect the roof structure.
4. Any decaying timber trusses and ceilings must be removed.
5. Rebuild the central Roof, Jack
6. Putting down fresh clay tiles
7. Attaching the water-proofing membrane to the roof
8. Remove and replace the rotting wood floor.
9. Remove the crumbled plaster.
10. Replastering and lime wash painting the wall
11. Rebuild the crash and fractured column to its original shape.
12. Repair and re-point loose mortar from exposed brickwork.
13. repairing any deteriorated doors, windows, and fanlights
14. Putting down a new wood floor and securing it

## 2.2 Maintenance Programme

Maintenance programme is essential in ensuring the success of heritage building maintenance. This is because systematic management can reduce costs as well as be able to thoroughly examine the issues faced to preserve the cultural value of the heritage building. Among the important factors in ensuring the quality of maintenance programme are [11]:

1. A well-organized and efficient management system
2. Maintenance contractor classification method
3. Consistent standards and codes
4. The cooperation of management and technical grouping
5. Institutional and management training facilities

There are three (3) approaches that have usually been used in historical building conservation [10]:

### 1. Restoration

Restoration is the method of find and obtain the condition and specifics of a design or part of the building, as well as its setup, as they did appear at a specific point in time, by erasing later work and replacing the defective original piece, and encompasses full restoration, that mostly contains respectively internal and external work. When it comes to reconstructing misplaced parts and removing accretions, restoration procedure is required. When original material and legitimate papers are retained, the reassembling of relocated components is permissible.

### 2. Preservation

Preservation refers to the goal of preventing future degradation, disintegration, or dilapidation while also ensuring safety of the structure and well-being. Do carry out preservation in a really way that the evidence of the fabric's construction or use is not obliterated.

### 3. Reconstruction

Reconstruction is the practice of exactly duplicating the shape and detailing of a destroyed building, or a portion of it, as it existed at a certain point in time by new construction, and comprises complete or partial reconstruction. Whenever a site is incomplete and rebuilding is both required for it is own existence and displays the cultural values of the site as it is now is reconstruction permissible.

## 2.3 Heritage Building in Batu Pahat

The features of the buildings found in Penggaram Town Center are comprised of pre-war and post-war shop houses with having the architectural styles of Early Modern Style, Early Colonial, Early Shop House, Eclectic Style, Art-Deco Style and Neo-Classical Style. Based on the sources of the Malaysian Heritage Board, Bandar Penggaram has 430 pre -war buildings, which is 18% of the pre -war buildings found in the State of Johor (Malaysian Heritage Board, Urban Heritage Preservation). Most of the pre-war shophouse buildings in Penggaram Town have Eclectic style architecture built in the 1920s which is 262 units (60%) of the entire pre-war building. This can be identified through the facade, the shape of the windows, the height of the building as well as the carvings found on the walls of the building. In addition, Early Colonial style architectural buildings total 101 units (23%) built around the year [12].

## 2.4 Influencing Factor in Effective Maintenance Programme

Several factors must be considered in the maintenance management system before it can be considered effective. Among the factors that influence the effectiveness of heritage building maintenance programmes are [13]:

1. The financial

The cost/budget of maintenance is the most significant component in the Administration Heritage Building Care Management System since the building is an ancient building that requires regular maintenance to guarantee that it remains in excellent shape. Aside from that, to control the total cost of maintenance on the administrative historical building, the relevant bodies require a greater fee.

## 2. The material

The deterioration is a major issue for the historic structure. As a result, the Heritage Building required maintenance work to ensure its quality and safety. Because it concerns historical value, which the maintenance officer must maintain in an attempt to preserve the historical worth of every structure, the technician maintenance should use the same material to repair the damage of the buildings.

## 3. Skilled workers

Workers are the most important asset in managing and carrying out maintenance tasks. Because of the necessity to preserve the legacy value of historical buildings, skilled and unskilled labor is in great demand for heritage building upkeep. The skilled employees will supervise and direct the maintenance operations, while the unskilled workers will do the maintenance work on-site. As a result, they are both connected.

## 4. Work procedure

The maintenance work for a heritage building differs from that of a modern structure since, in addition to maintaining the building's condition, the maintenance responsibility must also protect the architectural and historical worth of both buildings. As a result, the officially scheduled work must allow for clarity and efficacy. Also, to make a maintenance team aware of and comfortable carrying out maintenance tasks. As a result, the maintenance work will be more effective and the building's quality will be maintained indefinitely.

## 5. Organizational chart of management

The organization chart portrays a management team that is responsible for the upkeep of the Heritage Building. There is a group of people that are in charge of planning maintenance work, either for the future or for the present. Aside from that, some are in charge of controlling the execution of maintenance work based on the guidelines, because, as previously said, heritage buildings require special precautions

### 3 Methodology

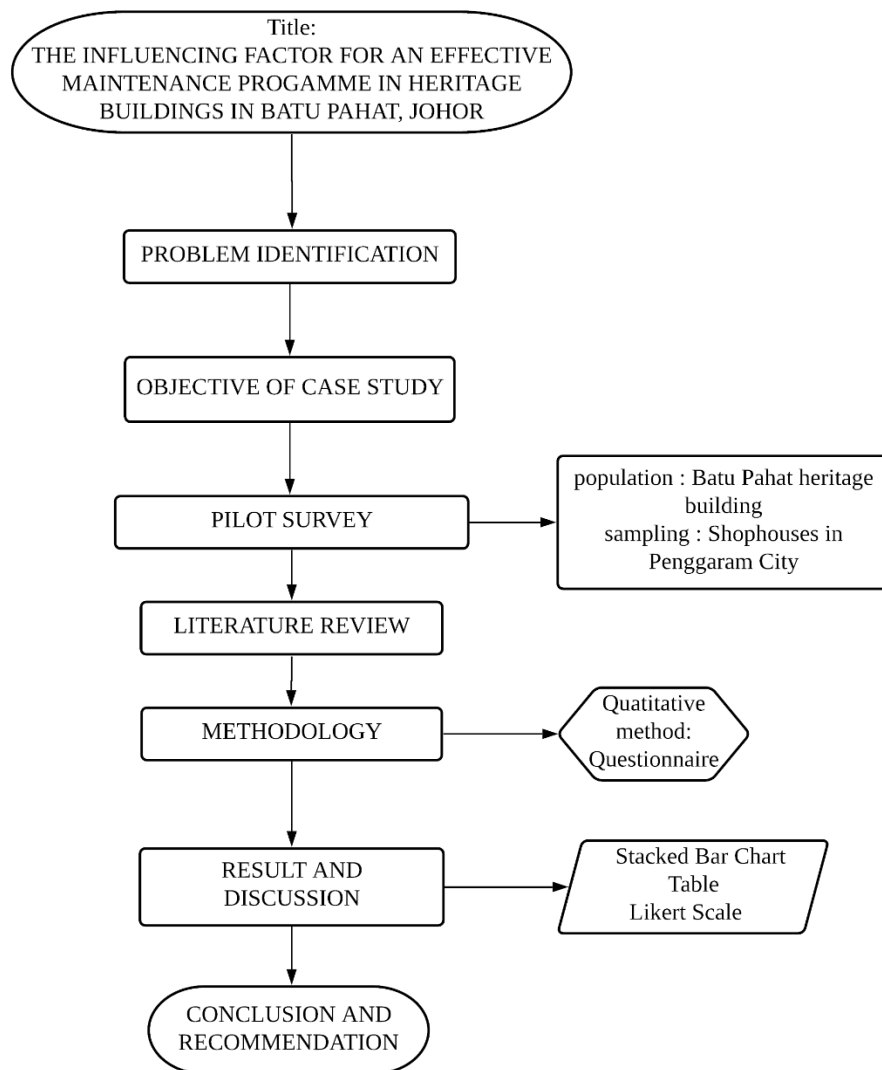
This case study was done using a method that is a structured survey. During the interviewing process, the respondent was asked a question and a Likert scale was used to collect the required data. A total of ten (10) people were involved in the data gathering process:

1. An academican in the built environment,
2. Staff of Dato' Onn Gallery
3. Officer of Batu Pahat Municipal Council
4. Officer of Jabatan Kerja Raya Batu Pahat

Above all, the use of qualitative research helped to exclude respondents who did not meet the criteria stated above, ensuring that the sample was representative of the population in Batu Pahat, Johor. The criteria of respondent are:

1. Ever been directly involved in the maintenance work of heritage buildings
2. Has experience in planning maintenance programmes.
3. Has credibility in the field of heritage building maintenance or maintenance in general

This method was carried out in order to fulfil the first and second objectives. The structure survey was done, and the respondent was given various questions. The respondents were asked to rank the influence factors and criteria of effective maintenance programme in heritage building in terms of Batu Pahat heritage buildings by using Likert Scale. The data will be analyzed based on the average index method by placing a scale for all the answers given by the respondents in the questionnaire. The average index method is to calculate the average of all answers based on the Likert scale that has been given to find whether the question or statement is not agreed, neutral, or agreed by all respondents by giving score for each question along with the interpretation for each range score. The methodology flow chart as follows in figure 1:



**Figure 1: Research Methodology Flow Chart**

#### 4 Results and Discussion

Through reading the literature review, several factors that influence the effectiveness of the maintenance programme and the criteria for an effective maintenance programme for heritage building are obtained. In the structured survey form, there are 5 main factors in the questionnaire form including financial, management organization, the procedure of work, material, and skilled workers as follow in table 1.

**Table 1: The factor of effective maintenance programme in heritage building**

<b>Factor</b>	<b>Sub-factor</b>
<b>Financial</b>	<ol style="list-style-type: none"> <li>1. Sufficient funds to maintain the buildings.</li> <li>2. Predict labour and material costs in maintenance accurately and clearly.</li> <li>3. Allocation of budget for specific maintenance work.</li> <li>4. Maintenance cost prediction tool and prioritization of building defects have been incorporated into the best practice guidelines.</li> <li>5. Maintenance work expected as a result of a natural disaster.</li> </ol>
<b>Management Organization</b>	<ol style="list-style-type: none"> <li>1. Good understanding and awareness of the significant value of the buildings</li> <li>2. Systematic maintenance planning and development; maintenance staffing; handling maintenance information and maintenance control.</li> <li>3. High concern of future maintenance of existing maintenance team.</li> <li>4. Good communication between maintenance contractor, clients (owners) and users.</li> <li>5. Systematic periodic inspection by the authorities for heritage buildings.</li> </ol>
<b>Procedure of Work</b>	<ol style="list-style-type: none"> <li>1. Advance in preventive maintenance method.</li> <li>2. Clear building maintenance standard procedures.</li> <li>3. Clear guidelines and technical manual for conservation works.</li> <li>4. Clear guidelines for custodians of heritage buildings in managing the maintenance of the buildings. Maintenance cost prediction tool and prioritization of building defects have been incorporated into the best practice guidelines.</li> <li>5. Systematic periodic inspection by the authorities for heritage buildings.</li> <li>6. The availability of standard guidelines for the owners to refer to in maintaining their heritage buildings.</li> </ol>
<b>Material</b>	<ol style="list-style-type: none"> <li>1. Availability to replacement parts and components.</li> <li>2. Availability in getting the original material to reconstruct the buildings.</li> <li>3. Availability of same material to maintain the significance of culture.</li> <li>4. The original materials are still being manufactured.</li> <li>5. No logistical problems in transporting materials to the heritage building maintenance site.</li> </ol>
<b>Skilled Workers</b>	<ol style="list-style-type: none"> <li>1. Availability of workers with skills and technical expertise in conservation technique.</li> <li>2. Competent in repairing the building fabric very close to the original using traditional techniques and traditional matching materials.</li> <li>3. Able to perform good rectification on buildings.</li> <li>4. Able to identify and prevent problems and defects to the building in the future.</li> <li>5. Availability of skilled appointed maintenance personnel.</li> </ol>

The criteria of an effective maintenance programme need to be seen from several important aspects to illustrate the state of a successful and effective maintenance programme in caring for heritage buildings. Therefore, these 10 questions have been provided in the questionnaire form as below in table 2:

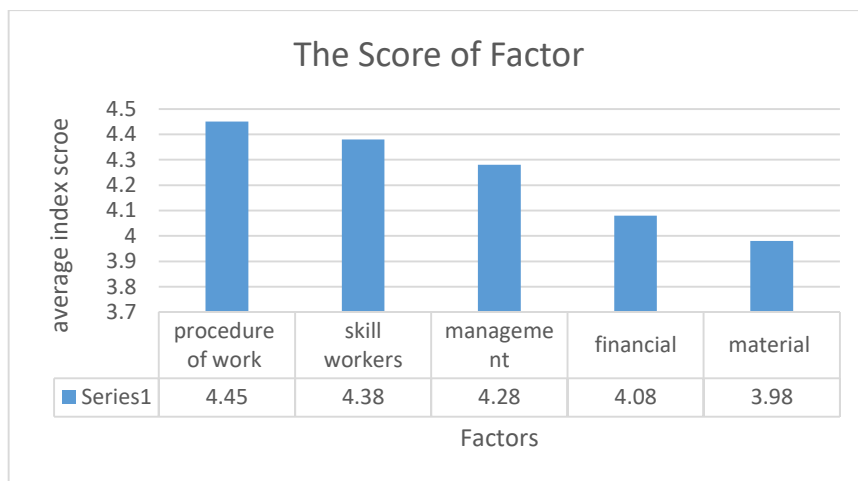
**Table 2: The criteria of effective maintenance programme in heritage building**

<b>No</b>	<b>Criteria</b>
1	Retention of the original structure.
2	Systematic in handling damage prevention methods, defect rectification and planning for emergency cases.
3	Able to identify and prevent problems and defects to the building in the future.
4	The maintenance of a heritage building is done without unnecessarily disturbing or destroying the heritage element.

5	Maintain the element of the building without altering the features which give the building value, structure and cultural significance.
6	Enhances the quality of life for everyone in the community.
7	Contribute to regeneration and provide a source of local pride.
8	Perform regular and scheduled inspections in order to conserve the buildings and help in long-term maintenance planning.
9	The information management systematically handle and store important maintenance information such as the records of past development and condition of the building, maintenance work carried out and the amount spent on the building.
10	Effective maintenance programme can prevent the conditions that increase future cost.

### 3.1 Most Influence in Effective Maintenance Programme

Among the factors agreed by all respondents as follow in figure 2 was the work procedure factor with a score of 4.45. Work procedures very important as it serves as a clue to an agency or building owner to look at the workflow for maintenance. The standard of a maintenance programme can also be standardized based on the national heritage act 2005 In addition, professional factors and employee expertise are important factors agreed by all respondents with a score of 4.38. The maintenance work is important to perform by skilled and experienced workers in the field of heritage building maintenance because the structure and facade of heritage buildings require very detailed and careful work in repairing in order to maintain the heritage element of the old building. Finally, the factor that plays a role is also the management of the organization with a score of 4.28. It can be concluded that a maintenance programme is highly dependent on the smooth management of the organization because the task of carrying out maintenance work depends on the agency organization or the owner of the heritage building itself.

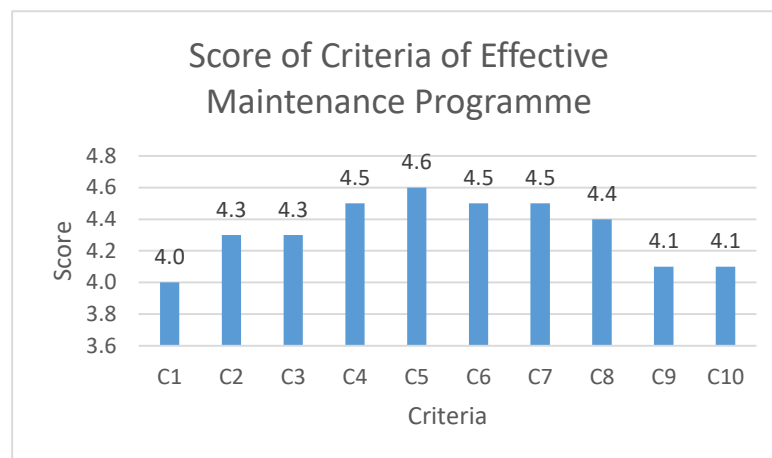


**Figure 2: The Overall of Each Factor**

### 3.2 Criteria of Effective Maintenance Programme

Based on the results of the questionnaire form that has been filled by the respondent, as can see in figure 3, among the criteria that have been agreed upon by the respondent is the fifth criteria (to perform regular and scheduled inspections to conserve the buildings and help in long-term maintenance planning) with a score of 4.6. In addition, respondents also agreed that the fourth criteria (contribute to regeneration and providing a source of local pride), the sixth criteria (the information management systematically handle and store important maintenance information such as the records

of past development and condition of the building, maintenance work carried out, and the amount spent on the building) and the seventh criteria (effective maintenance programme can prevent the conditions that increase future cost) with a score of 4.5



**Figure 3: The overall for Each Criteria**

## 5 Conclusion

The most influence factors in effective maintenance programme in heritage building were work procedures. Work procedure serves as a guideline to an agency or building owner to look at the workflow for maintenance. This important to ensure that the goals in the maintenance programme are accurate and uniform according to set standards so that the quality of heritage buildings can be maintained in terms of structure and cultural values in the heritage building. In addition, skilled workers also important factors agreed by all respondents. the maintenance of heritage buildings as it relies on employees to carry out the work of conservation and care of heritage buildings either repairing or replacing building components. Skilled workers are very important to avoid mistakes that occur due to negligence and wrong actions made. Lastly the other crucial factor is the management of the organization. The organization's efficient management is crucial to the maintenance program's success. This is due to the fact that the responsibility of doing maintenance work is delegated to the agency organization or the heritage building's owner. From the top down to the executor to the technical task, the organization covers the hierarchy.

In conclusion, this study found that the criteria of to execute regular and planned inspections to conserve the structures and aid in long-term maintenance planning are importance to an effective maintenance programme. Furthermore, the important criteria of effective maintenance programme are the information management systematically handle and store important maintenance information such as records of past development and condition of the building, maintenance work carried out, and the amount spent on the building. Lastly, effective maintenance programme can prevent the conditions that increase the cost of the building are also significant criteria of effective maintenance programme.

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