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Heritage Building Roof Element Conservation: Penang Old Town Hall Case Study

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Abstract. Heritage building roof element conservation is a way to maintain the heritage and prolong the use of a historic building. In addition, the aims are to ensure that historic buildings that have been preserved don't face the problem of damage and preserve architectural design. The objective of this study was to identify types of roof elements defects of colonial historic buildings and their causes. The survey is done to achieve this objective by inspecting the building. The survey results showed that various types of roof defects are caused by water. Conservation methods should be taken by owner to preserve the historic buildings from damage. Hopefully this study will give a better understanding of the conservation of the historic building roofs.

Keywords: conservation; heritage building; roof element; defects.

1. Introduction

Malaysia is famous for its valuable heritage building. An inventory made by the National Museum in 1992, showed there are about 35,000 heritage buildings, which predate the war. However, according to Ahmad [1], most of the buildings are not well conserved and are in dilapidated condition because of the age. So, conservation must be made in order to prevent the building decay. Conservation is a process of repair and refurbishment of a place such as building, monument or historic site, so the cultural importance can be maintained. It is aimed at the avoiding of a decay, destruction, misuse or neglect. Besides, conservation process is focused on the maintenance of original architecture, used materials, workmanship and the layout of a building.

A preliminary research should be done before any conservation work. In order to conserve a building, the maximum information, concerning its history, architecture, name of the owner should be gathered. This information can be obtained by interviewing the owner, the residents and the council. Besides, an old document or previous reports can be obtained from the museum, archive, library or any heritage organization. After that, a dilapidation survey should be made to identify the defects by making photographs.

According to Ahmad [2], the basic principles of conservation work are to minimize the intervention, carry out a scientific research and laboratory tests, document the conservation works and apply the method or technique of conservation that is proven effective. Conservation of heritage building is important, because any heritage building reminds us the past and enhances the spirit of patriotism [3]. Besides, it can attract tourists to Malaysia and invite economic income to Malaysia and contribute to the development of the travel industry [4].

According to National Heritage Department, conservation of heritage buildings in Malaysia can be divided into two categories, conservation of colonial buildings and conservation of traditional buildings [5]. The conservation of colonial buildings cannot be carried out, using the same method as in European countries, despite the identical architectural design, because the climate in our country climate differs from the European one [6].

This paper presents roof elements defects of heritage buildings and their causes. Figure 1 shows Penang Old Town Hall in 1900s and 2012. The Old Town Hall was a British colonial building and the oldest Municipal Building in Penang, which construction started in 1879 and was completed in 1880. It fronts the famous Esplanade in Penang Island. After the completion, Penang

Old Town Hall housed municipal council offices, Penang Library and private college. Now, it is closed for some conservation work inside the building. The floor space of this two-storey building is 30,552.23 square feet. It was extended 5 times in its history from 1890 to 1991.



Figure 1: Penang Old Town Hall in 1900s (left) and Penang Old Town Hall in 2012 (right)

2. Methodology

In order to identify the roof element defects of this building, a few procedures were made. First of all, the building with the access to the roof was found and the approval of the owner of this building was got. After getting the permission, a necessary document, such as historical evidence (e.g. old photo), original and new roof plan and previous research was made to make an inspection. The visual inspection and roof walk was made. All roof defects were recorded by taking photographs.

3. Observation, Results and Data Analysis

The Old Town Hall has a pitched roof. The roof covers the area of 15,000 square feet and it is estimated that about 160,000 pieces of roof clay tiles are needed. The roof clay tiles were taken from Besut, Terengganu. These hand-made V-shape tiles are 217mm in length and 7mm in thickness. As the roof tiles are a little narrower at the end, the width varies between 118mm and 134mm while the height is between 39mm and 45mm. Since each roof tile doesn't have nail hole and holds its original form, cement mortar is required to secure and stabilize the installation of roof tiles. Besides, the roof has balusters at the roof parapets. The balusters, located at the roof parapets were placed between the concrete decorative urns. Careful inspection to detect the roof elements defects of Old Town Hall was carried out. The visual inspection method was used to collect the data by roof walking. Due to some problems in accessing the roof area, only some part of the roof was inspected. The defects, the inspection had detected were as follows:

- a) Broken and missing roof tiles
- b) Damaged gutter
- c) Timber decay
- d) Fungal stains appeared on the roof tiles and roof parapets
- e) Cracked parapet balusters

a) Broken and Missing Roof Tiles

Broken and missing roof tiles were found on the roof of the heritage building. Besides, the tiles broke because the workers stepped on them, while doing the installation. The maintenance officers confirmed that the roof tiles were broken due to the crows pecked on the roof tiles. Malaysian weather, as well as the expansion and contraction of tile caused the tiles break.

Roof tiles in the heritage building were missing due to the heavy rains that made the tiles slip off. The tiles were also missing because of the poor workmanship and violation of tiles vigilantly by the contractor during the installation. Figure 2 shows the broken and missing roof tiles that can lead to the leaks.



Figure 2: Broken and missing roof tiles

b) Fungal Stains

Fungal stains also appeared on the roof tiles and along the roof parapets. Generally, fungal stains can diminish the aesthetic value of the building. If there is water or high moisture in the roof tiles and roof parapets, the fungal stains or mold will appear. This defect can be identified by changes in original color and the appearance of the building elements. Figure 3 shows the fungal stains that appeared on the roof tiles that from inside of the building.



Figure 3: Fungal stains at roof tiles

c) Gutter Damage

The common problem with the roof gutter is the gutter damage. Figure 4 shows the broken and damaged gutter, as it lies on the roof tiles. The possible cause of the gutter damage and brake is of the overflow of water due to the heavy rain. The timbers that suppose to hold the gutter are also deteriorated.



Figure 4: Gutter damage

d) Timber Decay

The timbers of this building were also decayed. The timber was decayed due to the weather. The weather conditions, such as rain and sun caused the timber deterioration. Figure 5 shows the timber decay on the beam.



Figure 5: Timber beam decay

e) Cracks

The causes of building cracks can be detected by the inspection. Thermal variations caused expansion and contraction of building materials and resulted in cracking. Historic buildings cracks decrease the aesthetic value of the building and contribute to other defects, such as water absorption, as well that may cause adhesive failure. Figure 6 shows the baluster cracks at the roof parapet.



Figure 6: Baluster cracks at the roof parapet

4. Conclusion

Conservation of roof elements of heritage building is important because roof is one the most important element of any construction. The roof collapse or damage affects the whole building. The roof of this building is in poor condition especially the roof tiles. It should be replaced as soon as possible with the same material in order to maintain its aesthetic value. Other defects should be also submitted by using the method, employed by contractors and conservators in Malaysia. The main cause of all defects is the weather, as the roof is exposed to rain and sun. As the roof tiles are broken, fungal stains will appear and leaks will occur during rain. Even though conservation is still new in Malaysia, efforts to protect buildings against damage and preserve them for the future generations have been taken.

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Консервация элементов кровли объекта культурного наследия: на примере старой ратуши Пенанг

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Аннотация. Консервация кровли объекта культурного наследия – это способ сохранить наследие и продлить пользование объектом культурного наследия. Кроме того, целью исследования является гарантия того, что находящимся под охраной объектам культурного наследия не грозит порча, а архитектурный дизайн остается неизменным. Целью данного исследования является определение типов дефектов кровли колониальных исторических зданий и их причины. Исследование проведено с целью решить данную задачу с помощью проведения инспекции здания. Результаты исследования показали, что вода является причиной различных типов дефектов кровли. Методы консервации должны использоваться владельцем, чтобы предотвратить порчу объекта культурного наследия. Мы надеемся, что данное исследование обеспечит лучшее понимание консервации кровлей объектов культурного наследия.

Ключевые слова: консервация; объект культурного наследия; элемент кровли; дефекты.