PERAK HERITAGE MOSQUES: EVALUATING THE DEFECTS OF BUILDING ELEMENTS

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ABSTRACT

This research attempts to investigate the type of defects of heritage mosque. The aim of this research was to investigate the defects of building elements of heritage mosque in Perak. The observation method was used to evaluate the defects of building elements in heritage mosques. Data were presented as descriptive analysis with the evidence of pictures, table, and graph. The result concluded that there are cracks, peeling paint, fungus and missing/ broken parts most defects in building elements of heritage mosques. In conclusion, this work would be able to assist the government or mosques administration in preparing maintaining strategy of heritage mosques.

Keywords: *Defects, Building elements, Heritage mosques, Perak*

INTRODUCTION

A mosque is a place of worship for Muslims. Commonly, mosques are located in urban and rural areas where the majority of the population are Muslims (Ahmad, 1999). According to Ahmad (1999), in Malaysia there are three (3) architectural styles of the mosques based on the corresponding built periods such as vernacular mosques (18th century to date), colonial mosques (1795 to 1957) and modern mosques (1958 to date). Vernacular mosques and colonial mosques can be categorized as heritage mosques. Johar, S., Ahmad, A. G., Che-Ani, A. I., Tawil, N. M. and Usman, I. M. S (2011) stated that heritage mosques are the same as other historic buildings which had also made significant contributions in the history of the country. In the rapid development of modern buildings, heritage buildings such as government administrative buildings, schools, mosques and so on are still standing, although some seem to be having defects.

Defects are defined as the deterioration of building characteristics and services to unsatisfactory quality levels of users' requirement Johar, S., Che-Ani, A. I., Tawil, N. M., Surat, M. and Kamaruzzaman, S. (2013). Defects of the building can affect the condition of the buildings either in terms of aesthetic, comfort, and safety of occupants. The building structure is easily exposed to environmental conditions and changes in conditions due to human errors in the design of any building structure. Defects can easily be detected in heritage buildings because these buildings have long being exposed to environmental conditions. Normally, there are many problems of defectswhich are common to the heritage building elements such as roofs, walls, floors, ceilings, toilets, doors, and windows Mansor, R., Mydin, M. A. O., Ismail, M. and Wan Harun, W. M (2012)The elements of the buildings that had been exposed to the defects have caused the aesthetic value of the buildings. Defects can occur at any heritage buildings if the buildings were not maintained properly.

According to Johar et al. (2011), 85% of heritage mosques are still being used and the remainder is either being repaired or left empty. Most of the damages and defects in the building are at the roof area, followed by the wall, column, windows, doors, household, flooring and beam. The problem of defects on the part of the building structure can be severed if left without immediate action. The building defects contribute to building

collapse and can cause injury or death to humans. Therefore, this research aims to investigate the defects of the heritage mosque. Thus, it is hoped that the findings can help the government in preparing maintenance strategy of the building elements of heritage mosques.

LITERATURE REVIEW

The Mosque

A mosque is a place of worshipping God, such as prayer specifically for the Muslims. The main activity of the mosque is the performance of congregational prayers (Mohamad Rasdi, 2007). According to Mohamed et al. (2012), a mosque is one of the unique buildings in terms of the design of the building, the roof shapes and the building components, which are normally not presented in other buildings. The basic features of the mosque are extensive prayer space, minaret, dome, Mihrab, Mimbar, Sajadah and ablution area. Besides, the prayer space in the mosque is extensive without any hitches such as a table, chair, and others.

The Heritage Mosque

Heritage should be preserved for the present time and will be inherited for the future generations (Harun, 2011). This means that the heritage mosque is a mosque that has been maintained for the present generations and will be inherited for other generations to come. The heritage mosque has the historical value of its own and unique design which can show the characteristics of the local culture. The mosque has always been associated with Islam. The growth of Islam in the Malay Peninsula became more prominent in the early 15th century during the Malay sultanate of Malacca (Ahmad, 1999). The rapid growth of Islam led to numerous built of mosques during that time. Many mosques with traditional architectural style were built to hold prayers and other activities associated with the teachings and dissemination of Islam.

The Heritage Mosque in Perak, Malaysia

Dzaenis (2014) identified many heritage mosques in Perak, including Masjid Dato' Panglima Kinta (built in 1898), Masjid India Muslim (1908), Masjid Kampong Paloh (1912), Masjid Pakistani (1930), Masjid Sultan Idris Shah II (1968), and Masjid Ubudiah (1917). All of the mosques mentioned are located in Ipoh, Perak except for Masjid Ubudiah. Masjid Ubudiah is located in Kuala Kangsar, Perak. Besides that, Masjid Ihsaniah Iskandariah is also in Kampung Kuala Dal, Padang Rengas, Kuala Kangsar. This mosque was built in the year 1936. In December 2008, the National Heritage Department under the Ministry of Information, Arts and Culture has undertaken the conservation works towards the mosque (Abdul Rashid et al., 2013). Masjid Tinggi is a special mosque at Bagan Serai, Perak. The mosque was built by a tribe of Banjar around the year 1890 (Muhammad, 2014). The Masjid Tinggi mosque has a design that is attractive and has been restored by the Museum. However, the mosque is now no longer used and has been used as a national heritage (Muhammad, 2014).

Type of Defects

A building defect can be defined as a material, component or finishes, which does not meet its accepted performance criterion (Mydin et.al, 2012). Building defect is also involved in the building flaw or design mistake that reduces the value of the building and causes a dangerous condition (Wen and Mydin, 2013). According to Burden (2004), defects in building lead to a situation of inequality or irregularity that happened which led to the damage or weaken the strength of the structure, durability or the use of heritage buildings. The review of the literature shows the types of the defect from previous research from 2004 until 2014, within 10 years (Table 1). This table also shows the existence of a defect in heritage buildings and mosques. The eleven types of defects that occur in a heritage building and mosques have been reviewed, synthesized and selected for the use in this research. The defects are leakage, cracks, peeling paint, spalling, salt attack, insect or termite attack, dampness and moisture, decay, the growth of fungus, moss or small plant, missing or broken parts, and erosion of mortar joints.

Table 1: Past 10 years of Research on Defects of Heritage Buildings

Types of Defects	Authors & Years
Leakage	Abdullah Halim and Abdullah Halim (2010); Mustafaraj (2013); Ahmad (2004); Talib, et.al (2014)
Cracks	Abdullah Halim and Abdullah Halim (2010); Johar et al. 2011);Mustafaraj (2013); Ahmad (2004); Talib, Ahmad and Sulieman (2014) ; Johar et al. (2013); Mansor et al. (2012);; Talib et al., (2014)
Peeling Paint	Abdullah Halim and Abdullah Halim, (2010); Johar et al. (2011); Johar et al. (2013); Mansor et al. (2012); Ahmad (2004); Talib et al., (2014)
Spalling and Salt attack	Mansor et al (2012) ;Berthonneau et. Al (2012) ; Ahmad and Abdul Rahman (2012);Mansor et al. (2012)
Insect or Termite attack	Abdullah Halim and Abdullah Halim (2010);Johar et al. (2011);Johar et al. (2013);Mansor et al. (2012);Ahmad (2004);Talib et. al (2014)
Dampness or Moisture	Abdullah Halim and Abdullah Halim (2010);Johar et al. (2011);Johar et al. (2013);Ahmad (2004)
Decay	Abdullah Halim and Abdullah Halim (2010); Johar et al. (2011);Johar et al. (2013);Ahmad (2004); Berthonneau et al. (2012)
Growth of Fungus	Abdullah Halim and Abdullah Halim (2010);Ahmad (2004)
Unwanted Growth of Plant	Abdullah Halim and Abdullah Halim (2010);Johar et al. (2011);Johar et al. (2013)
Missing or Broken Parts	Abdullah Halim and Abdullah Halim (2010); Johar et al. (2011);Johar et al. (2013)

Defects vs Building Elements

This section describes the relationship of type of defects and building elements. A thorough review has been done from previous research related to the heritage building defects. The building elements that had been mentioned throughout the literature are work below lowest floor finishes, frame, upper floor, wall, ceiling, door, window, plumbing, roof, staircase and external works. Table 2 shows the summary of defects according to the building elements related to the heritage building.

Table 2. Defects vs Building Elements

Element	Sub Element	Defects
Work Below Lowest Floor Finish	Floor	Cracks, insect or termite attack, dampness and moisture and peeling paint.
Frame	Column	Decay, insect or termite attack, dampness and moisture, cracks and peeling paint.
	Beam	Insect or termite attack, dampness and moisture, cracks and peeling paint.
Upper Floor		Decay.
Wall		Cracks, the growth of fungus, moss or small plant, peeling paint, dampness and moisture, decay, insect or termite attack and salt attack.
Ceiling		Decay.
Door		Decay, insect or termite attack, dampness and moisture, growth of fungus, moss or small plant, cracks and peeling paint.
Window		Decay, insect or termite attack, dampness and moisture, the growth of fungus, moss or small plant, cracks and peeling paint.
Plumbing		Leakage.
Roof		Leakage, missing or broken parts, insect or termite attack, decay, cracks, the growth of fungus, moss, or small plant and peeling paint.
Staircase		Decaying, insect or termite attack, dampness and moisture, the growth of fungus or small plant, cracks and peeling paint.
External Work		Missing or broken parts.

The leaking problem exists along with inadequate ventilation, such as skirting against a wall affected by rising dampness and window and door frames that have long been exposed to damp conditions (Johar et al., 2013). According to Abdul-Rahman, H., Wang, C., Wood, L.C. and Khoo, Y.M. (2014). leakage also occurs at both the external walls and wet areas, such as the kitchen and toilet. The cracking of external walls which affects the water pipes can cause leaks (Abdul-Rahman et al., 2014). In addition, the crack defect also occurs because the concrete expands and shrinks due to the extreme and rapid exchange of the weather from cold to hotwhich makes the concrete expand and shrink rapidly (Mansor et al., 2012). Furthermore, peeling paint usually occurs on building facades, mainly on plastered walls, columns and other areas, which are exposed to excessive rain and dampness

(Md.Kasim, 2009; Mansor et al., 2012 & Ahmad, 2004). The amount of constant wind, rain, and sun received can easily turn the surfaces of the paint to become chalky and wrinkled or blistered (Ahmad, 2004).

According to Mansor et al. (2012), the factors for spalling are due to extreme weather exchange, chemical reaction, the inferior quality of concrete and unsuitable reinforcement. The extreme weather exchange causes the concrete to expand and shrink rapidly and eventually causing the concrete to spalling due to irregular checking (Mansor et al., 2012). Based on a research by Mansor et al. (2012), concrete building that is exposed to the chemical reaction can easily decay and contribute to the concrete spalling if not remedied. Besides, insects, particularly termites and wood destroying beetles are well known in causing disastrous losses in timber buildings (Johar et al., 2013). In addition, insect or termite infestation poses a threat to damp and digestible timber found in wall plates, the feet of rafters, bearing ends of beam and trusses, as well as in the timbers, which are placed against or built into damp walling (Mansor et al., 2012 & Ahmad, 2004). The effects of termite attacks are generally detected by the hollow-sound heard when tapping the wood on the surface (Kamal, 2007 cited in Johar et al., 2013).

Furthermore, the dampness or moisture is naturally produced from evaporation, which resulted from the living activities in the building (Mansor et al., 2012). Moreover, high moisture content or dampness at heritage wall may cause almost every part of the building to experience a very serious defect and a prompt action must be taken before the cost is affected (Abdullah Halim and Abdullah Halim, 2010). According to Ahmad (2004) and Abdullah Halim and Abdullah Halim (2010), dampness penetration through walls can be a serious matter, particularly to buildings that are located near water sources. The components of building from timber such as a window, door, and floor are seriously defected such as decay due to exposure from dampness and weather effects (Abdullah Halim and Abdullah Halim, 2010). According to Mohammed (2002) and Mansor et al. (2012), another factor of the decay is because of moss invasion, wear and tear and due to the weather. Fungi are a group of organisms in the plant category that can cause decay and discoloration of cellulose material such as wood (Ridout, 2000 cited in Johar et al., 2013). According to a research by Abdullah Halim and Abdullah Halim (2010) on heritage building, the surface of column and wall are also affected by mould, moss and fungus

attack. Fungal stains or mould occur when there is moisture content in the walls (Ahmad, 2004).

According to a research by Abdullah Halim and Abdullah Halim (2010), broken roof covering on heritage building can cause building to be exposed to the rain and sunlight. Most of the goods that were exposed to continuous rainwater may cause broken, decay, corroded and damaged to the building so badly and this situation will cause inappropriate water flow and the surface of the wall and floor will be highly moisturized and attacked by fungus (Abdullah Halim and Abdullah Halim, 2010). Basically, the main function of a mortar joint is to even out irregularities of individual blocks whether they are of stones or bricks (Md.Kasim, 2009 & Ahmad, 2004). According to Md. Kasim, (2009), wind and rain erode mortar. Besides, causes of mortar joint erosion include salt crystallization, scouring action of winds, the disintegrating effects of the wall-growing plant, and water penetration which would result in dampness (Ahmad, 2004). Salt weathering occurs most often during the hot season (the summer months of November to April in the southern hemisphere) due to lower relative humidity and stronger sunlight (Mansor et al., 2012; Ahmad and Abdul Rahman, 2010). According to Arayanak (2002), Mansor et al. (2012) and Ahmad and Abdul Rahman (2010), large temperature changes and increases the rates of evaporation. This may trigger more upward water movement in the building wallsdue to the process of salt crystallization. Moisture from the rising damp makes the building's existing salts soluble, or ground water that contains salt find its way through the building wall (Ahmad and Abdul Rahman, 2010).

Backgrounds of Mosques

KampungPaloh Mosque

The original name for this mosque is Mohamedan (Hazelan, 2014). Kampung Paloh mosque is located in Jalan Datoh, Ipoh. Kampung Paloh mosque was built by Orang Kaya-Kaya Dato 'Seri Adika Di Raja Wan Mohamed Salleh in 1912. There were three contributors that built the mosque in Paloh. The first contributor was Toh Puan Saripah Binti Duakap, the second contributor was Dato Panglima Bukit Gantang Mahmud Bin Mohd Taib and the last one was Hj Long Mohd Kassim Bin Ngah Banja

Jugra Bin Pandak Maon Bin Panglima Kinta Ngah Sudin. Kampung Paloh mosque is surrounded by a cemetery, one minaret, and the shape of the roof of the mosque is inclined and terraced. The area of this mosque has one building for toilet and one building for the dining room. Inside the mosque, there is a place for ablution, room for Imam, pantry room and mausoleum.

Dato Panglima Kinta Mosque

It is also known as the "Central Mosque". It was built by Dato 'Panglima Kinta Mohamed Yusof in 1898 to commemorate his wife who passed away. This mosque is located at Jalan Masjid namely on the edge of the Kinta River and near to the Bridge of Sultan Iskandar that crossed the Kinta River (As-Samaki, 2013). Around the Dato Panglima Kinta mosque, there are two minarets, a central dome and the roof features, which are both flat shaped and inclined shaped. This mosque also has one mausoleum and one building for rest-room. Besides the mosque, there are places for ablution and toilets. The material used to build this mosque is of solid stone. The concept and design of the dome shown in the picture are to match the features and appearance of the mosques in the golden age of Moghul in

India. The entire corridor space in the mosque was installed with a grill to prevent the incidence of theft.

India Muslim Mosque

The mosque is also known as 'Masjid Padang Kota' because it is located opposite of the Padang Ipoh. This mosque is an old mosque of the Hanafi sect, which is located along Jalan S.P. Seenivasagam. It was founded by Sheikh Adam, a member of the Tamil Indian community of Southern India, in 1908. At the beginning of the construction, the main purpose was to gather the Indian Muslim community who are mostly businessmen living in this area. This mosque has an interesting architecture that combines the Moghul architecture that is almost identical to the Diwan-i-Khas in Delhi, India. The India Muslim mosque has two minarets and the features of the roof are shaped with a flat roof and some parts have an inclined roof. The area of this mosque involves one toilet and a place for ablution.

Pakistani Mosque

This mosque is located in Jalan Chong Kong, Ipoh and was built in the 1930's for the Punjabi Muslims who were brought here to work for the police

force. The mosque is also known as the Police Mosque and the name was changed into Pakistani Mosque in 1949. Pakistani mosque has no minaret while the roof of the mosque is in inclined shaped. The surrounding of this mosque has toilet, place for ablution, room for Imam and pantry room.

Ubudiah Mosque

This heritage mosque is known as Ubudiah Mosque, which is located next to the mausoleums of the Royal Bukit Chandan, Kuala Kangsar. This mosque is also known as the Royal Mosque. The mosque is built in 1887 by Sultan Idris Murshidul Adzam Shah, the Sultan of Perak. Ubudiah mosque was built with an architectural influence of `Saracenic' (Islamic-Indian). The shape of this mosque is octagon and has four towers. It is 126 feet tall and is surrounded by domes of which every diameter is measured over 60 feet. The onion-shaped domes of the mosque were taken from the Indian Moghul architecture. The surrounding of this mosque consists of toilets and places for ablution.

METHODOLOGY

The observation method is the main method in collecting data about the defects of heritage mosques. Preparation of observation checklist is made to identify the type of defects and simplify the observation on heritage mosque. Five (5) heritage mosques were selected for observation. The details of the selected heritage mosques for this research is shown in Table 3.

Table 3: The List of Heritage Mosques Surveyed in the Research

Types of Defects	Location	Year Built
Dato' Panglima Kinta Mosque	Ipoh	1898
India Muslim Mosque	Ipoh	1908
Kampong Paloh Mosque	Ipoh	1912
Ubudiah Mosque	Kuala Kangsar	1917
Pakistani Mosque	Ipoh	1930

Observation and Defects Checklist

In order to get the data through observation method, observation checklist is provided to ease the researcher to identify the types of defects at the heritage mosques. Design of checklist observation was based on literature review in order to achieve the first research objective. The checklist consists of the type of defects and building elements. The observation was carried out in the vicinity of the mosques such as outside the mosque and inside the mosque. The observation was made to see if there were any defects inside and outside the mosques. The defects found were marked in the observation checklist. Photos of defect areas were taken as an evidence to show where the defects are in the mosques. Through the observation method, defects in heritage mosques were determined.

RESULTS

This section presents the defects of the 5 selected heritage mosques in Perakwhich are Kampung Paloh Mosque, Dato Panglima Kinta Mosque, India Muslim Mosque, Pakistani Mosque and Ubudiah Mosque. Every mosque has its own characteristics and different designs.

The Defects of Heritage Mosque in Perak

Observation of the defects was made based on the observation checklist. In the observation checklist, there are 11 types of defects (leakage, cracks, peeling paint, spalling, salt attack, insect or termite attack, dampness and moisture, decay, growth of fungus, moss or small plant, missing or broken parts and erosion of mortar joints) and 13 elements of the building

(floor, beam, column, roof, wall, ceiling, door, window, plumbing, sanitary fitting, drainage, sundries and staircase). Table 4 shows the summary of building elements that have defects at the five selected heritage mosques.

Table 4: Summary of No of Defects in 5 Selected Mosques

Mosques/Types of Defects	Leakage	Cracks	Peeling Paint	Spalling	Salt Attack	Insect or Termite Attack	Dampness and Moisture	Decay	Growth of Fungus, Moss of	Missing or Broken Parts	Erosion of Mortar Joints	Total
Kampung Paloh Mosque	-	6	5	2	1	-	3	2	4	4	1	28
DatoPanglima Kinta Mosque	1	5	7	-	2	2	5	2	7	5	-	36
India Muslim Mosque	-	5	6	1	2	2	2	1	6	7	1	33
Pakistani Mosque	-	5	4	1	1	-	1	3	3	4	1	23
Ubudiah Mosque	-	7	3	1	3	3	4	1	7	6	-	35
Total	1			5	9	7		9			3	155

Figure 1 shows the percentages of defects that exist at the five heritage mosques. The types of defects are cracks, growth of fungus, moss or small plants, have some missing or broken parts, peeling paint, dampness and moisture, salt attack, decay, insect or termite attack, spalling, erosion of mortar joints, and lastly leakage. The defect that has the highest percentage is cracked constitute about 18%, while the defect that has the lowest percentage is leakage with 1%. Based on the result of observation obtained, defects of heritage mosques in Perak are mainly cracks.

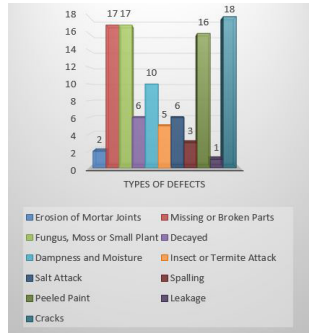

Figure 1. Defects of Heritage Mosques in Perak

Most of the defects that happened in heritage buildings are cracks. Based on the observation made, the findings showed that all heritage mosques selected have cracks defect. Cracks are often caused by the pressure of excessive load either it is live load, dead load and wind load to the building. It can become serious with the aging of the building. Due to aging, the building strength will reduce because the frame of the building is dilapidated. The heritage mosques are mosques that had long been built and the defect of cracks can be easily seen in the element of building on the mosques. The lowest case of defect that can be found in the heritage mosques is leakage defect. Leakage defects can occur in the heritage mosques, but these defects do not occur frequently. Leakage defect often occur where there is a cracked water passage, broken or missing part of elements, decay and so on. It happens if there is water in the passage. In addition, leakage defect is rarely being found in the heritage mosques because not all elements of the building are involved with the passage of water.

CONCLUSION

This research contributes to assist the mosque management in understanding the defects. The defect can be avoided if more regular inspection and maintenance are done. In addition, the better workmanship of building is another way to reduce defects that should be implemented by the mosque management. This is because better quality construction workmanship can prevent the occurrence of defect.

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