MOSQUE BUILDINGS MAINTENANCE COSTS IN MALAYSIA

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ABSTRACT

Mosque is one of the unique buildings in Malaysia. The dome and spire structure of the mosque illustrates Islamic identities of this building. Unfortunately, the lack of emphasize on the maintenance issues of the roof structure effect the artistic value of the roof. The main objective of this research is to identify the method of maintenance work carried out for roof structure of Mosque which inclusive of dome, roof finishes and drainage system. This is followed by the second objective which is to identify the maintenance costs for maintenance works carried out to roof structure of Mosque. The data collection was carried out through semi-structured interview and documents review. Semi-structured interview were conducted towards Civil and Building Technicians because they are the individuals who are responsible to carry out maintenance works to the Mosque building. Data collected from the interview session include the types of common defects incurred at roof mosque, causes of defects and the method of repairing defects. On the other hand, Bills of Quantities were reviewed to identify costs for maintenance works. All the data was analyzed by using mean score method, and frequency percentage method. The result from this research indicates that most frequently used maintenance methods are replacing damaged roof finishes with new packaging. Costs for roof maintenance are divided into three main elements which are maintenance cost for domes, roof finishes and drainage systems. The study found that maintenance on the roof finishes elements involve higher maintenance costs compared with the other two elements.

Keywords: mosque, maintenance, cost, dome, roof finishes.

1.0 INTRODUCTION

Defects in the roof of the building became a problematic issue when it is involved massive amount of maintenance costs to be allocated by government. There are many types of defects that occur in the roof such as leakage, collapse, decay, fade, and so
forth. Such defects affect the government budget because it will increase the maintenance costs (Ahmad, 2004). According to former Prime Minister of Malaysia, Dato' Seri Abdullah Ahmad Badawi (2007), such incidents occur due to lack of maintenance aspects undertaken by the government agencies.

Although the maintenance of the mosque’s roof is less reported, it does not mean that mosque do not have roof defects. An example of a mosque which has defects in the roof structure was Masjid Kampung Batu Putih, Kerteh, Kemaman, Terengganu which the structure of the mosque’s roof collapsed. This incident occurred when repairing works were carried out on the occurred leaks. Repair works has been carried out after the roof of the mosque leaked over three months (Bulletin Online, 2009). Among the factors causing this to happen was the delay of maintenance works.

Other mosques that are also experiencing a significant defect in the roof structure was the National Mosque in Kuala Lumpur. Recently, the Government has approved immediate allocation of RM 9.5 million to reinstate the National Mosque. Minister of Works, Datuk Shaziman Abu Mansur mention that the provision was including work on repairing leaking roofs, drainage systems, toilets, loud speaker system and improving the appearance of the mosque and Makam Pahlawan located at National Mosque (Bernama, 2010).

Based on the example cases above, clearly indicates that maintenance should be focused on the elements of the roof. This is because, if the defects occur in the roof structure is not maintained properly, a defect will increase and will impact more severely on the roof structure. It also affects the cost of maintenance where the cost will be increase. Every year, the cost of maintaining, repairing damage and defects in the building including the roof has increased wisely. If early steps are not undertaken, then the total expenditure to be spent on repair work will be increased.

According to monitoring record conducted by the Jabatan Pengurusan Masjid in Jabatan Agama Johor in collaboration with the Pegawai Tadbir Agama Daerah-Daerah Negeri Johor, for RMK-9, there were 126 Kariah Mosques and seven Government’s Jamek Mosques has been listed for the maintenance work or rebuild, estimated to cost up
to RM 126 million. Overhaul and rebuild of the mosque is due to lack of effectiveness in the maintenance of mosques and causing the mosque to look old. (Nurul Huda, 2008)

Normally, the defects occur in the roof structure is depend on the roof construction type. For the mosque roof, the design is different from the normal roof design. Mosque roof structures are usually equipped with a dome structure (kubah) as a religious symbol. Thus, the method of maintenance done on the mosque’s roof structure involves not only finishes of the roof and drainage system, but it also involves the structure of the dome. By identifying effective methods of maintenance on all three parts, the defects on the roof of the mosque can be reduced and thus reduce maintenance costs.

2.0 MAINTENANCE OF MOSQUE ROOF

According to British Standard 38112 (BS 38112), maintenance is defined as work done to maintain or restore every facility, i.e. every part of the site, buildings and contents to an acceptable standard (BS 38112, 1974). Maintenance of the building can be divided into two main processes i.e. maintenance and repair.

Maintenance is work done to keep the building in order to fulfil the desired function. Repair works is performed to repair defects that occur to the building back to its original condition for fulfilling the desired function. Specialists in the maintenance of the roof define the functions that are required as a condition that may allow the use and value of such a facility (Baharin, 2006).

British Standards 3811 (BS 3811) has been divided into two categories: maintenance of planned maintenance and unplanned maintenance. Planned maintenance can be divided into two types that is, prevention maintenance and maintenance repair. Prevention maintenance is divided into two periodic maintenance and maintenance based on condition (Seeley, 1987). The types of maintenance are summarized in Figure 1.

![Maintenance Diagram](image-url)
2.1 Mosque’s Roof Maintenance Method

Maintenance of the roof consists of three elements, namely the maintenance of the dome, roof finishes and drainage systems. According to Hasmn (2004), the maintenance of the roof should be done more frequently, at least once a year. It aims to identify the damage earlier and prevent these defects becoming more severe. Early action can reduce expenditure on repairs.

2.1.1 Dome Maintenance

i. Dome Repainting

Maintenance of the dome structure, especially on the finishes is to be done the right way so it does not affect the aesthetic or decorative structure. Among the methods of maintenance carried out are repainting the dome surface. This method is carried out on the surface of the dome when the color of the dome structure is fading. This method can be used on all types of domes, i.e. concrete, aluminum or steel.

ii. Patching Cracked and Leaked area
In the event of leaks or cracks are small and not serious, the method is carried out to patch the holes and cracks on it to shut down the flow of rain water. For dome made from aluminum and steel, the material used for filling is silicone. As for the concrete dome, a layer of cement (plaster) is used.

iii. Grouting Cracked Concrete Structure

For dome made of concrete, in the event of a serious crack, step that can be taken is to grout the area with concrete mix. This will ensure the strength and reinstate the structure to the original state.

iv. Replacing the Dome Structure

If the defect occurs in the dome is very serious and cannot be repaired by the above rules, other step that can be taken is to replace the dome structure with a new dome structure.

2.1.2 Roof Finishes Maintenance

Maintenance for roof finishes is important for it is the outer part of the roof where it provides protection for the roof structure. The finishes are consists of roof coverings such as tiles, metal and concrete layers. Among the methods that are done on the roof finishes are:

i. Concrete or Clay tiles

Tile that dated from the original position or moved back into position is to be affixed with stainless steel nails. For tiles that have been damaged, it must be replaced with new tiles in the affected areas. But if the damage involves a large number of tiles, the replacement for all tiles shall be done (Nurizuana, 2008).

ii. Concrete Surface
Inclination of the surface of the flat roof should be sufficient so that rain water can flow well into the roof drain. If water pools on the surface of the roof, it can be solved by placing insulator on the roof surface so that the terrain become hillier and the rain water can drain. For waterproof layer that is torn or vesicle, replacement should be done on defective parts only. However, if the damage is involving large area, replacement of whole layers is to be done. (Nurizuana, 2008) Fractures that exist in the concrete structure can be repaired by grouting the cracks using the mixture of cement.

iii. Metal Sheet Deck

The maintenance of metal sheet deck is the same as the tiles where replacement will be done when it is damaged and leaking. Corrosion occurring in these materials can be overcome by stainless steel coating the surface with paint or fluorocarbon.

2.1.3 Drainage System Maintenance

Drainage system shall be designed in accordance with the capacity of water flowing through it. Maintenance of these systems should be done regularly to ensure the flow of rain water to drain running smoothly. The drainage must be cleared of trash, leaves and other dirt so that the water flows are not blocked by these materials (Ahmad, 2004). In addition, if the existing drainage system could not accommodate the water flow, outlet should be added around the roof. According to Mohd Fadzlie (2008), other methods of maintenance for aluminium type of drainage is to tighten the bracket that is loose, replace the bracket that had broken down and increase the number of the drain brackets so that it can accommodate the load of water flowing through it.

If the drainage system has a serious defect and its size cannot accommodate the flow of water, maintenance method that can be taken is to replace it with a new drainage system. While the rift that occurred in the concrete gutter is maintain by grouting it with cement mix. In addition, in the event of leakage or damage at the waterproof layer, the method that can be performed is to repair the waterproof layer at the concrete gutter area.

3.0 RESULTS AND DISCUSSION
Five mosques were selected as sample for this study. The mosques are Mosque A, Mosque B, Mosque C, Mosque D and Mosque E. Mosque A, Mosque B and Mosque C are located in Selangor and Mosque D and Mosque E are located in Johor.

3.1 Roofing Maintenance Methods Conducted Over Sample Mosque

The method for roof maintenance is divided into three elements which are the dome, roof finishes and drainage systems. Studies carried out on five samples of the mosque are to identify maintenance methods that are often used to repair the mosque’s roof defects. Figure 3 shows the method used by the five samples of the mosque.

<table>
<thead>
<tr>
<th>Maintenance Method of Mosque Roof</th>
</tr>
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<tbody>
<tr>
<td>Repainting waterproof layer</td>
</tr>
<tr>
<td>Grouting cracked concrete structure</td>
</tr>
<tr>
<td>Replacing the drainage system</td>
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<tr>
<td>Increase the number of drainage</td>
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<tr>
<td>Cleaning blocked drainage</td>
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<tr>
<td>Cleaning mossy area</td>
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<tr>
<td>Repainting waterproof layer</td>
</tr>
<tr>
<td>Grouting cracked concrete structure</td>
</tr>
<tr>
<td>Reassemble dated finishes</td>
</tr>
<tr>
<td>Replacing roof finishes</td>
</tr>
<tr>
<td>Replacing dome structure</td>
</tr>
<tr>
<td>Grouting cracked concrete structure</td>
</tr>
<tr>
<td>Patching cracked and leaked area</td>
</tr>
<tr>
<td>Repainting the dome surface</td>
</tr>
</tbody>
</table>

Figure 3: Min scores for maintenance methods carried out at the dome, roof finishes and drainage systems.
Figure 3 shows the method of maintenance which located on the ranking 1 is replacing damaged roof finishes with the new finishes. Min score value for this method is 3.60 and it is classified as rare. Replacement method is divided into two that is to replace the defective part of finishes or to replace the entire finishes. It depends on the defects and the need of replacement. If the defect involving most of the finishes or the defect finishes affects the other, it requires total replacement. But if the defects are only involving a small part, the replacement is done in the area of the defects alone.

While the method at the lowest ranking with a min score of 1:00 is replacing the structure of dome. This method is classified as rarely used. Usual action taken on the structure of the dome is painting the surface of the dome and patching the leak surface of the dome.

3.2 Comparison of Maintenance Costs for sample Mosque

Any maintenance works carried out will affect the overall cost of a building. The total cost depends on the type of disability occurred and maintenance methods that are taken. It is similar with the mosque roof. The level of damage will determine the method of maintenance to be carried out. Thus, the total cost of maintaining the mosque roof each varies according to type of disability occurred and the method of maintenance work. Table 1 summarizes the cost of maintaining the mosque roof of the samples. These costs are based on current records of maintenance work carried out on five samples of the category of unplanned maintenance.

<table>
<thead>
<tr>
<th>Project</th>
<th>Year Built</th>
<th>Year Maintenance</th>
<th>Roof Maintenance Cost (RM)</th>
<th>Area (M2)</th>
<th>Cost/M2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mosque A</td>
<td>2002</td>
<td>2010</td>
<td>123,691.00</td>
<td>14,300</td>
<td>8.65</td>
</tr>
<tr>
<td>Mosque B</td>
<td>2003</td>
<td>2010</td>
<td>44,000.00</td>
<td>2,074</td>
<td>21.21</td>
</tr>
<tr>
<td>Mosque C</td>
<td>1998</td>
<td>2010</td>
<td>10,446.50</td>
<td>918</td>
<td>11.38</td>
</tr>
<tr>
<td>Mosque D</td>
<td>2002</td>
<td>2010</td>
<td>7,920.00</td>
<td>6,000</td>
<td>1.32</td>
</tr>
<tr>
<td>Mosque E</td>
<td>1930</td>
<td>2007</td>
<td>182,656.00</td>
<td>988</td>
<td>184.87</td>
</tr>
</tbody>
</table>
The analysis is carried out by removing the total maintenance cost involved for the roof from the overall cost of building maintenance works. This cost is derived from the bills of quantities from recent maintenance works performed at Mosque A, B, C, D and E. Comparison of cost per square meter (cost/m²) will be performed on the five mosques to identify the highest cost for maintaining the roof.

According to Table 1, Mosque E has the highest cost of maintaining the roof that is cost per square meter (cost/m²), RM184.87/m² and the overall cost of roof maintenance is RM182, 656.00. If we compare this cost with the other four samples of the mosque, a significant difference can be identified. In addition, the recent maintenance performed on Mosque E was in 2007. This means that the overall cost of maintenance is taken is based on its costs in 2007 and not the latest overall cost. Because of that, Mosque E is not appropriate as a reference for the study compared with other samples of the mosque.

Based on four samples of Mosque A, B, C, and D, Mosque A has the highest cost for maintaining roof with a total of RM123, 691.00. While the cost per square meter (cost/m²) for maintenance is RM8.65. The total cost obtained is different for each mosque, because it depends on the prevailing defects and maintenance methods taken. Maintenance costs are high because the mosque roof maintenance performed involving a wide area. For Mosque A, the maintenance is performed on the finishes. Despite this, roof finishes for the mosque is divided into two main finishes, on the pitch roof and flat roof. Maintenance is carried out involving the two of them. For pitch roof, only damaged metal deck is replaced with new metal deck finishes. As for flat roof, maintenance methodology involves the entire area which includes cleaning, installation and replacing the primary layer of waterproof coating. The cost of repairing the waterproof layer is the highest cost among the costs involved for maintaining the roof that is RM120, 960.00. Because of this, the maintenance cost for mosque A is higher than the other mosques.

Mosque D has the lowest cost of maintaining the roof with total cost of RM7, 920.00 and the cost per square meter (cost/m²) is RM1.32. This is because not much maintenance works were carried out for the roof because the defects that occurred are not too significant. The maintenance only involves the finishes and the dome. The main method carried out at the finishes part is replacing the damaged tiles with new ones. Other
maintenance involves are more than just side job like painting decorative cornice. Similarly, the dome, due to the defects that occur are mild, the method carried out is not too complex and does not cost a lot. Some of the maintenance action taken for the dome is replacing the rubber connection to the dome, and patching silicon on the leak. Based on the carried out maintenance work, it clearly shows that the overall cost is not too high a cost.

4.0 CONCLUSION

Maintenance is mostly carried out on the mosque roof finishes. When compared with the dome structures and drainage systems, defects are more likely to occur in these areas. Therefore, there are various measures can be used to overcome defects problem. The most common method used for that part is replacing the damaged roof finishes with new finishes.

In terms of maintenance costs, the expenses cost is different for each method used. Roofing maintenance costs are very high when compared with other elements of the building. This is because the maintenance work involves three main parts which is the dome, roof finishes and the drainage systems. Each part requires different maintenance methods and involving different materials.

Results from studies shows that roof finishes elements involves a higher maintenance costs compared to the elements of the dome and drainage system. These elements include in flat roofs finishes and pitch roofs finishes. Pitch roof involves more maintenance works than flat roofs. If the pitch roof involves surface or concrete structure, its maintenance cost is higher due to water-proof layer replacement cost is very expensive.

Each method of maintenance should be done more carefully and efficiently as it seeks to restore the aesthetic value of the original roof design. Experts are needed to implement these methods. Thus, everything involved in the implementation of these works will affect the total cost of maintenance.
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