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IMPLICATIONS OF DEFECTS IN BUILDING CONDITION OF HERITAGE MOSQUES IN PERAK

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ABSTRACT

Preserving and maintaining heritage buildings, including mosques, is crucial to ensure their continued functionality and benefits for all age groups in Malaysia. Some mosques in Malaysia have been recognized as heritage monuments under the National Heritage Act of 2005 (Act 645) due to their historical significance. Defects in heritage buildings not only diminish the level of comfort but also impact the structural integrity of such buildings, potentially leading to injuries and compromising their overall quality and performance. Therefore, it is essential to investigate the types of defects present and their implications on the building condition of heritage mosques located in Ipoh, Perak. For purposes of this research, three heritage mosques were selected based on their distinct characteristics. A qualitative research design was employed, involving interviews with the mosque management. Each case study required two respondents to partake in the interview sessions. Using the Building Condition Assessment (BCA) method, it was determined that 18% of the total defects in the three selected heritage mosques were related to cracks. Specifically, the India Muslim Mosque accounted for 14% of the cracks, Kampung Paloh Mosque accounted for 2%, and the remaining percentage of the cracks are found at Dato' Panglima Kinta Mosque. The significance of this study lies in identifying the types of defects prevalent in heritage mosques and determining the effectiveness of the BCA method in minimizing these issues. The findings will be valuable to mosque management, aiding them in maintaining these cultural and historical landmarks for future generations.

Keywords: *building condition assessment, defects, heritage building, mosque*

INTRODUCTION

Heritage is a term used to describe elements of a society's culture that were developed in the past but still have historical significance; this includes traditions, languages, and built environments (Cambridge, 1995). There are two main types of mosques that can be distinguished: the masjid jāmiʿ, or "collective mosque," which is a substantial state-run mosque that serves as the centre of communal worship and conducts Friday prayer sessions, and smaller mosques that are privately run by various social groups (Adam, 2022). Malaysia is the location of numerous mosques, some of which have been recognised as heritage monuments under the National Heritage Act of 2005 (Act 645) due to their historical significance and their ties to the nation's past. A heritage mosque is subject to the provisions of Act 645 regarding its administration and development as it is a gazetted site. The aim is to ensure that these historic buildings or sites are always preserved and conserved to be handed down to future generations (Mohamed et.al, 2021). Maintenance is the most important component of conservation. Regardless of whether a problem is mechanical, architectural, or botanical, prevention is always preferred to treatment (Kerr Semple, 1996). There are a variety of inspection techniques available, such as visual inspection, which is a very straightforward, non-destructive method frequently used to evaluate the health of buildings and other structures (Jorge et.al, 2021). We will be able to learn more about the buildings being inspected using this technique.

Related Policies

The National Heritage Act of 2005 defines the term ‘heritage’ as referring to any heritage site, heritage object, underwater cultural heritage, or any living person designated as a National Heritage. Cultural heritage and natural heritage are the two distinct categories of heritage. Cultural heritage includes both tangible and intangible forms of cultural property, structures, and artefacts. It may also include heritage matters, objects, items, artefacts, formation structures, performances, dances, songs, and musical compositions that are important to Malaysians' historical or modern way of life, whether they take place on land, underwater, or both. It also includes natural heritage (Act, 2005).

A defect is a flaw in a building or a mistake in the design that lowers the building's value and potentially creates a hazardous situation (Sigh et al., 2011). The level of comfort experienced by the building's occupants will decrease if there are defects present, and if the defects are serious, they could result in injuries to the occupants. Another concern is the preservation of this historic structure, which results in the need for appropriate maintenance procedures. One of the main building elements that would urgently require attention is a building defect. We need to promptly figure out the reason a building fails to function the way it should. The methods typically used

for ordinary buildings cannot be applied to the heritage buildings involved in this study because they are protected by the relevant legislation and must maintain their original structure.

Types of Defects

Cracks

According to Kartina et al. (2016), the term "heritage mosques" refers to mosques that have endured the passing of significant amounts of time, making it easy to identify the material fractures on the mosques. There are cracks in the mosques' columns, beams, walls, roofs, doors, windows, and staircases, according to Johar et al. (2011) upon his investigation into mosque problems. The rapid and jarring temperature changes of the concrete from cold to hot also contribute to the fractures because they cause the concrete to rapidly expand and contract, as claimed by Mansor et al. (2012). Cracks are frequently caused by excessive loads being applied to the building's elements, such as live, dead, and wind loads, according to Alauddin et al. (2018).

Rising damp / Dampness

Moisture from the developing damp or ground water that contains salt seeps through the building walls and this causes the salts that are already present to become soluble (Rahman et al., 2010). While the wetness is caused by roof leaks that enter through damaged walls, the moisture is caused by rising damp (Halim et al., 2010). Mortar joint erosion is also caused by salt crystallisation, wind scouring, the destabilising effects of plants that grow on walls, and water penetration that results in dampness (Ahmad, 2015). High moisture content or dampness at the heritage walls can lead to very serious flaws in nearly every component of the building; immediate attention must be given to prevent rising costs (Halim et al., 2010). The dampness or moisture is naturally produced by the evaporation brought on by human activity inside the structure (Mansor et al., 2012). The symptoms themselves, such as humidity, blistering and flaking paint, and crumbling lime plaster, make the wetness obvious (Halim et al., 2010).

Peeling of paint

Paint peels off building facades frequently, especially plastered walls, columns, and other areas that are excessively exposed to moisture and rain (Kasim, 2009). This claim is backed by Ahmad (2015), who asserts that repeated exposure to wind, rain, and sun can result in the paint's surfaces becoming chalky, wrinkly, or blistered. According to Mansor et al. (2012), paint peeling frequently happens on building facades, particularly on plastered walls, columns, and other places that are exposed to a lot of moisture and rain. On the surface of the walls, moss and fungi grow partially, and paint flaking is also an issue. According to Halim et al. (2010), this problem arises

as a result of water from the top seeping into the mortar joints and ceiling, causing ceiling degradation.

Insect or termite attacks and unwanted plant growth

The deteriorating wood structure is seriously threatened by termites (Halim et al., 2010). Termite attacks can typically be distinguished by the hollow sound that wood may make when tapped on its surface (Johar et al., 2011). Termites are among the invasive insects attacking buildings in tropical areas (Novita et al., 2020). The exterior wall is the next location, where the surfaces of the column and wall are attacked by fungi and unwanted plants like ficus. A flaw in the design of the rainwater goods leads to this incident (Halim et al., 2010).

Decay

According to Halim (2010), the floors, doors, and windows of a building all have significant flaws, such as deterioration caused by exposure to moisture and other environmental factors. The wooden components of the building, including the windows, doors, and floors, show significant flaws such as deterioration brought on by exposure to moisture and environmental factors, which is also supported by Halim et al. (2010). According to a study by Mansor et al. (2012), buildings made of concrete that are subject to chemical reactions are more likely to degrade and, if left unattended, contribute to concrete spalling. On the surface of the wall, moss and fungi grow partially, and paint flaking is a further defect. According to Halim et al. (2010), this problem arises as a result of water from the top seeping into the mortar joints and ceiling, causing ceiling degradation.

Broken or damaged parts

According to a heritage building study carried out by Halim et al., (2010), a broken roof covering had exposed the building under study to rain and sunlight. The investigation on mosque problems conducted by Johar et al. (2011) found there to be problems with missing or broken roof components. According to Burden (2004), construction flaws lead to unfair or irregular circumstances until they jeopardise or reduce a structure's strength, longevity, or suitability for use as a historic structure. The majority of products made with rainwater are severely damaged, rusted, rotted, and destroyed. Because of the improper water flow and high moisture levels, fungus will attack the surfaces of the building walls and floors (Halim et al., 2010).

Leakage

Although not frequently found, leakage defects in mosque heritage structures are possible (Alauddin et al., 2016). The symptoms, such as humidity, blistering and flaking paint, and crumbling lime plaster, make it clear that the area is wet. Defects are primarily caused by leaking roof structures, broken roof tiles, and poor rainwater products (Halim et al., 2010). Leakage flaws are rarely found in historic mosques

since not all construction elements are connected to the flow of water (Alauddin et al., 2018).

Table 1: List of Defects

Types of Defects	Authors
Cracks	(Kartina Alauddin, Mohd Fisal Ishakt , Haryati Mohd Isa and Fariz Mohamad Sohod, 2016)
	(Kartina Alauddin, Mohd Fisal Ishak, Muhammad Azim Muhamad Wazir, 2018)
	(Rozliani Mansor, Md Azree Othuman Mydin, Mazran Ismail, Wan Mariah Wan Harun , 2012)
	(S. Johar, A.G. Ahmad, A.I. Che-Ani, N.M. Tawil, I.M.S Usman, 2011)
Rising Damp	(Ahmad, A.G and Abdul Rahman , 2010)
	(Al-Hafzan Abdullah Halim, Anas Zafirol Abdullah Halim, 2010)
Dampness	(Dr. A Ghafar Ahmad, 2015)
	(Al-Hafzan Abdullah Halim, Anas Zafirol Abdullah Halim, 2010)
	(Rozliani Mansor, Md Azree Othuman Mydin, Mazran Ismail, Wan Mariah Wan Harun , 2012)
	(Al-Hafzan Abdullah Halim, Anas Zafirol Abdullah Halim, 2010)
Peeling Paint	(Rozliani Mansor, Md Azree Othuman Mydin, Mazran Ismail, Wan Mariah Wan Harun , 2012)
	(Dr. A Ghafar Ahmad, 2015)
	(Al-Hafzan Abdullah Halim, Anas Zafirol Abdullah Halim, 2010)
Insect or Termite Attacks	(Al-Hafzan Abdullah Halim, Anas Zafirol Abdullah Halim, 2010)
	(S. Johar, A.G. Ahmad, A.I. Che-Ani, N.M. Tawil, I.M.S Usman, 2011)
	(Novita Novita, Hasbi Amiruddin, Husaini Ibrahim, Teuku Muhammad Jamil, Syaukani Syaukani, Emiko Oguri and Katsuyuki Eguchi, 2020)
Decay	(Al-Hafzan Abdullah Halim, Anas Zafirol Abdullah Halim, 2010)
	(Rozliani Mansor, Md Azree Othuman Mydin, Mazran Ismail, Wan Mariah Wan Harun , 2012)

Corrosion	(Al-Hafzan Abdullah Halim, Anas Zafirol Abdullah Halim, 2010)
Broken	(Al-Hafzan Abdullah Halim, Anas Zafirol Abdullah Halim, 2010)
	(S. Johar, A.G. Ahmad, A.I. Che-Ani, N.M. Tawil, I.M.S Usman, 2011)
Missing	(S. Johar, A.G. Ahmad, A.I. Che-Ani, N.M. Tawil, I.M.S Usman, 2011)
	(Kartina Alauddin, Mohd Fisal Ishak, Muhammad Azim Muhamad Wazir, 2018)
	(Al-Hafzan Abdullah Halim, Anas Zafirol Abdullah Halim, 2010)

METHODS AND MATERIALS

Case Studies

The Dato' Panglima Kinta Mosque, Kampung Paloh Mosque, and India Muslim Mosque are the three (3) heritage mosques that were chosen for this study based on the type of mosque and its purpose, which allows for public visits. These Heritage Mosques were also selected because they have been gazetted as National Heritage by the National Heritage Department, with the approval of the Minister.

Table 2: Three (3) Selected Case Studies

No.	Item	Description
1	Name: Kg. Paloh Mosque Address: Masjid Kg. Paloh, Jalan Datoh, 31650 Ipoh, Perak Building status: Heritage Mosque Year of build: 1912	 **Figure 1: Kg. Paloh Mosque**
2	Name: Dato’ Panglima Kinta Mosque Address: 15, 3, Jalan Masjid, Taman Jubilee, 30300 Ipoh, Perak Building status: Heritage Mosque Year of build: 1896	 **Figure 2: Dato’ Panglima Kinta Mosque**

3	Name: India Muslim Mosque Address: Jalan Seenivasagam, 30450 Ipoh, Perak Building status: Heritage Mosque Year of build: 1908	 **Figure 3: India Muslim Mosque**

Architect Orang-Orang Kaya Dato' Seri Adika Raja Wan Mohamed Salleh finished construction of Kampung Paloh Mosque in 1912. Meanwhile, the building of Dato' Panglima Kinta Mosque was completed in 1898, and its style was influenced by regional, local, colonial (Neoclassical), and Moorish architecture as well as North Indian (Mughal) architecture. The India Muslim Mosque is a historic mosque. This mosque was built in 1908, inspired by Mughal, colonial, and regional traditional designs.

Observation

A visual inspection of each mosque was conducted, with particular attention given to the architectural and structural elements in order to fulfil the research objective and collect primary data. Each component defect was identified and rated according to its severity and maintenance priority. In addition to systematic note-taking, taking photographs, and making an educated assessment of the flaws observed, visual inspection also involved these elements. Various deficiencies were found during the observations, which were rated from 1 to 3 as shown in the matrix table.

Table 3: Matrix Table

No	Matrix	Score
1	Plan maintenance	1 to 4
2	Condition monitoring	5 to 12
3	Serious attention	13 to 20

The term "Building Condition Assessment (BCA)" is often used interchangeably with terms such as "capital need assessment," "backlog study," and "delayed maintenance study." BCA is typically conducted through walkthrough inspections, mathematical modelling, or a combination of both. Approaches like interviewing building occupants and assessing specific criteria are commonly utilized to gauge functionality. The sources of data for BCA often encompass a range of materials such as representative document samples, interviews, user surveys, satisfaction surveys, operator assessments, and condition monitoring (Yacob et al., 2016).

Interview

For this study, semi-structured interviews were conducted. There were some questions from the prepared list with the prepared answers, and some questions answered by the candidate. A face-to-face, two-way communication technique called individual interviews was used to carry out the interview sessions for this study. Each case study required two respondents to support the interview session for the purpose of analysis, and the details are as set out in the table below.

Table 4: Details of Respondents

No. of Respondents	Case Study	Gender	Position	Service Period
Respondent 1	Dato' Panglima Kinta Mosque	Male	Imam	1-3 (years)
Respondent 2		Male	Bilal	1-3 (years)
Respondent 1	Kampung Paloh Mosque	Male	Bilal	1-3 (years)
Respondent 2		Male	Siak	1-3 (years)
Respondent 1	India Muslim Mosque	Male	Imam	1-3 (years)
Respondent 2		Male	Bilal	1-3 (years)

RESULTS AND DISCUSSION

There were 31 defects discovered in Dato' Panglima Kinta Mosque. All the defects were discovered on the ground floor as Dato' Panglima Kinta Mosque is a one-storey building. A total of seven defects were discovered at the monitoring conditioning level, which fell between matrix numbers 5 and 12. The remaining individuals were in the maintenance plan category, which matrix score ranged from 1 to 4. Dato' Panglima Kinta Mosque's overall building rating, which ranged from 1 to 5, was at a good level with a score of 4.7.

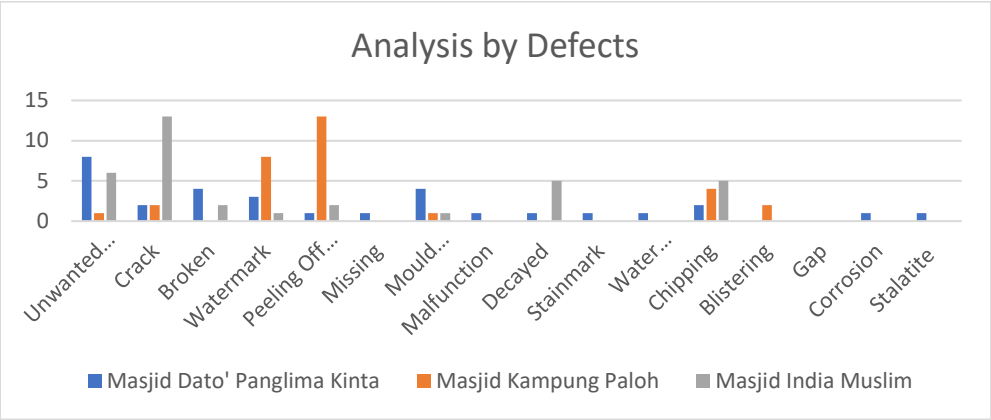
In total, 32 defects were identified at Kampung Paloh Mosque. There were nine monitoring-condition defects in the levels 5 to 12 of the matrix. Regarding the 23 remaining defects, each of them were in the monitoring plan category, or between the matrix score1-4. All the defects found were at the ground floor level Kampung Paloh Mosque. The Kampung Paloh Mosque's overall building rating from the scale of 1 to 5 was 4.6, indicating that the mosque was generally in good condition. Most of the defects found were minor defects but they can lead to serious problems if left unattended.

At the India Muslim Mosque, 35 defects have been found in total. A matrix value range of 6-9 and up to 13 defects can be found in the condition monitoring category. As many as 22 defects have been identified in the monitoring plan condition, with values ranging from 1 to 4, according to the matrix value for defects in the condition monitoring category at the India Muslim Mosque. The ground floor area of this mosque was where all the defects were discovered. The Indian Muslim Mosque's overall building rating is at a fair level with a total score of 5.5 within a range from 5 to 12. This is because a high percentage of the defects were found to be under the condition monitoring category.

Table 5: Details of Building Condition

No.	Case Study	Number of Defects	Total Marks of Matrix Assessment	Total Score	Overall Building Rating
1	Dato' Panglima Kinta Mosque	31	147	4.7	GOOD
2	Kampung Paloh Mosque	32	146	4.6	GOOD
3	India Muslim Mosque	35	193	5.5	FAIR

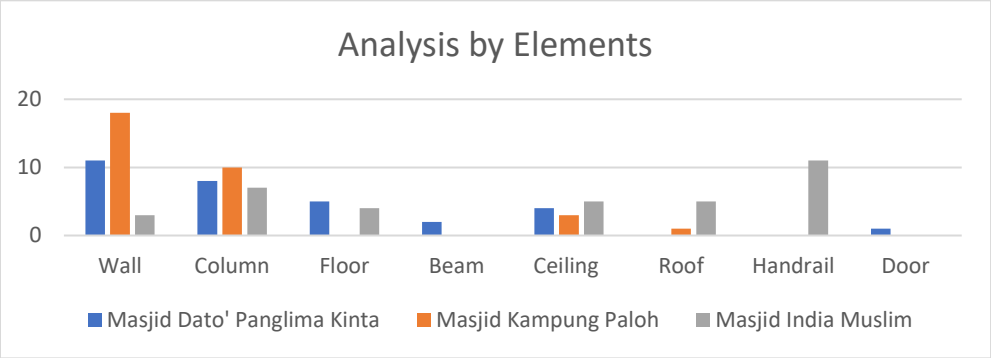
Figure 4: Types of Defects Analysis



As shown in the bar chart above, cracks are the most common type of defect found in the three mosques involved, which are as many as 18 defects related to cracks. The highest number of cracks are found in the India Muslim Mosque which totals to 14. For Dato' Panglima Kinta Mosque, there is at least one defect found related to missing, malfunction, stain mark, water penetration, corrosion and also stalactite found in the mosque. The second highest number of defects is from the peeling off of

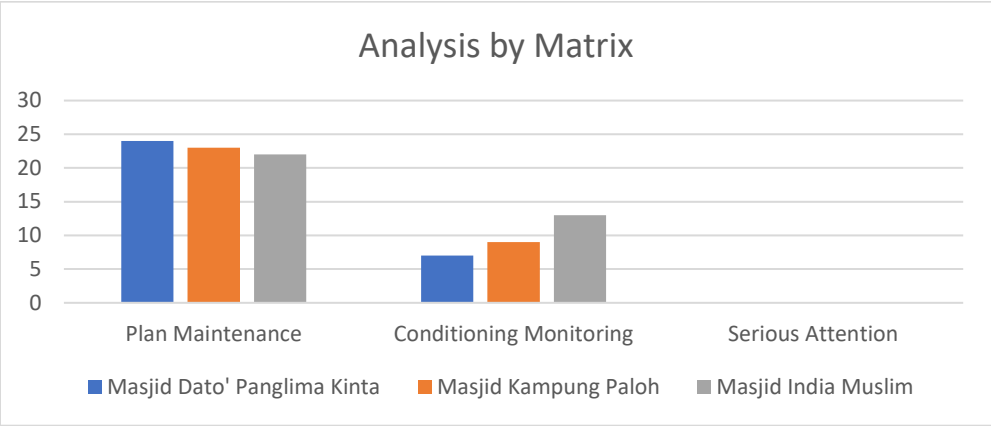
paint defect, which totals to 17 defects found for the three mosques, with the highest number found in Kampung Paloh Mosque.

Figure 5: Elements Analysis of Defects



The elements associated with each defect found in each of the selected mosques were analysed and shown through the bar chart above. For the three mosques examined, a total of 34 walls were discovered to be defective. Kampung Paloh Mosque had the most defects, with 18 walls found to be defective. The door is the component with the fewest defects, with one defective door found in Dato' Panglima Kinta Mosque. As many as 25 defects were found in the column element, which is the second-highest type of defective element after walls. Each of the three mosques have between seven and 10 defects related to their columns.

Figure 6: Matrix Analysis of Defects



As seen in the bar graph above, the three mosques which are Dato' Panglima Kinta Mosque, Kampung Paloh Mosque, and India Muslim Mosque have nearly identical readings. The highest number of defects is from matrix plan maintenance, ranging between 22 and 24, while none of the three mosques had defects with the lowest matrix requiring serious attention. The India Muslim Mosque has the most matrix for

condition monitoring, with a total of 13, and the Dato' Panglima Kinta Mosque has the fewest defects with a total of seven, according to matrix condition monitoring. Kampung Paloh Mosque has a total of nine defects as determined by matrix condition monitoring.

Based on the observations done through inspection, the following results can be drawn regarding the defect assessment in the three selected mosques:

1. Dato' Panglima Kinta Mosque: A total of 31 defects were found during the assessment, all of which were located on the ground floor. The remaining defects fall under the maintenance plan category, leaving seven in the monitoring conditioning category. Dato' Panglima Kinta Mosque received a good overall building rating of 4.7 out of 5.

2. Kampung Paloh Mosque: The mosque's ground floor was the location where 32 defects were found. There were nine defects under the monitoring condition category, while the remaining 23 defects fell under the plan maintenance category. With a score of 4.6 out of 5, Kampung Paloh Mosque's overall building rating is good. Although most of the defects are minor, they can lead to serious issues if left unattended.

3. India Muslim Mosque: A total of 35 defects were found during the inspection, all of which were located on the ground floor. The monitoring plan condition applies to the remaining 22 defects, leaving 13 at the condition monitoring level. With a score of 5.5 out of 12, India Muslim's Mosque overall building rating is fair. This is due to a significant portion of the defects falling under the condition monitoring category, which indicates a relatively higher severity.

CONCLUSION

It can be concluded that the assessment of defects in the three selected mosques reveal multiple levels of defects and conditions. The overall condition of Dato' Panglima Kinta Mosque and Kampung Paloh Mosque is good, with most of the problems falling under the maintenance plan category. The India Muslim Mosque, on the other hand, only received a fair rating because of a significant number of monitoring-level flaws found. To guarantee the mosques' long-term preservation and maintain their functionality for the worshippers, it is essential to address all identified defects.

The need for proactive preservation and restoration efforts is highlighted by defect assessments of selected historic mosques in Perak. The mosques can be preserved for future generations by putting the suggested strategies into practice, ensuring that their historical and cultural significance endures. These priceless religious and architectural landmarks must be successfully preserved, and community

involvement, cooperation with heritage conservation experts, and adherence to preservation guidelines are essential elements. In order to guarantee the ongoing maintenance and preservation of the heritage mosques in Perak, it is essential to allot resources and develop a long-term plan for ongoing maintenance and regular assessments. When looking at a heritage building, it is crucial to strike a balance between the need for repairs and upgrades and the preservation of the building's historical significance. To ensure that the building's distinctive character and cultural significance are preserved for future generations, it would be wise to hire professionals with experience in heritage conservation.

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2. Adalah dimaklumkan bahawa pihak kami ingin memohon kelulusan tuan untuk mengimbas (*digitize*) dan memuat naik semua jenis penerbitan di bawah UiTM Cawangan Perak melalui Repositori Institusi UiTM, PTAR.

3. Tujuan permohonan ini adalah bagi membolehkan akses yang lebih meluas oleh pengguna perpustakaan terhadap semua maklumat yang terkandung di dalam penerbitan melalui laman Web PTAR UiTM Cawangan Perak.

Kelulusan daripada pihak tuan dalam perkara ini amat dihargai.

Sekian, terima kasih.

"BERKHIDMAT UNTUK NEGARA"

Saya yang menjalankan amanah,

SITI BASRIYAH SHAIK BAHARUDIN
Timbalan Ketua Pustakawan

nar

Setuju.

27.1.2023

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