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Evaluation of Building Defects and Risk: A Case Study in Residential College UTHM Campus Pagoh

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Abstract

Building maintenance is essential for ensuring the durability, usability, and security of educational facilities. This study evaluates the condition of buildings at UTHM Campus Pagoh by identifying defects such as cracks, water leaks, peeling paint, mold, and termite infestations. The research involved on-site visual inspections and the documentation of defects using standardized checklists. A Risk Assessment Matrix was employed to analyze the data further, ranking maintenance requirements based on likelihood and severity. The findings indicate that the most prevalent and critical issues requiring immediate attention are structural cracks and water leaks. To enhance overall safety, comfort, and functionality, it is recommended to prioritize proactive inspection schedules, systematic maintenance planning, and efficient resource allocation. The establishment of a more reliable and sustainable maintenance management system at UTHM Campus Pagoh is strongly encouraged.

1. Introduction

Building maintenance is a vital part of managing facilities, as it affects the longevity, safety, and appearance of structures. Effective maintenance practices are essential for supporting academic activities and improving the overall experience for students. Many educational institutions have struggled with insufficient maintenance, which has led to higher operational costs, safety issues, and a negative learning environment [1]. This highlights the need for a systematic approach to maintenance, especially in older buildings where budget constraints can limit effective practices. Proactive maintenance is also crucial for reducing long-term costs and enhancing facility performance [2]. Other than that, a well-maintained environment directly influences how usable a facility is, allowing student councils to organize academic programs more effectively. So, with field inspections, it can provide valuable insights into the learning atmosphere, showing that well-maintained facilities are linked to higher student satisfaction and better academic performance [3].

In Malaysia, Public Higher Education Institutions are taking significant measures to ensure that all facilities are maintained in proper and safe condition [4]. By prioritizing maintenance, institutions can enhance occupant comfort and safety while avoiding costly emergency repairs and downtime. Effective building maintenance also ensures a facility's durability and safety. Building defects may happen in both new buildings and existing buildings [5]. Many buildings face problems like mold, cracks, peeling paint, and termite infestations, especially in areas with high humidity or frequent rain [6]. These issues often arise from poor maintenance planning, lack of funding,

and delayed inspections, leading to expensive repairs and potential health risks for occupants. To tackle these challenges, it is important to create a comprehensive maintenance plan that focuses on regular evaluations, timely repairs, and preventive actions. This plan should allocate budget resources for maintenance activities while addressing both structural integrity and aesthetic improvements. By taking a proactive approach, institutions can extend the life of their buildings and ensure a safe, comfortable environment for users.

As for the aim of this study is to evaluate building maintenance practices at Block A14 Residential College, UTHM Campus Pagoh, by analyzing recurring defects to create a better learning environment. Regular maintenance is crucial for ensuring safety, functionality, and aesthetics, encompassing daily inspections and preventive measures. This study involves identifying and documenting defects to understand the structural issues affecting the facility. Following this, the research will assess the impact of these defects on the building's overall strength and durability. This systematic approach will provide valuable insights into the campus's maintenance needs and inform future strategies for enhancing safety and longevity.

2. Methodology

Assessing building maintenance is important to ensure the longevity and functionality of facilities. This study aims to evaluate the current state of building maintenance Blok A14, UTHM Pagoh Campus. There are some defects that can be classified as non-material and material load-bearing walls [7]. This study has focused on non-material defects such as cracks, mold, peeling paint, termite infestation and leakage. It also outlines the evaluation criteria, data collection methods, and analytical techniques used to gain relevant insights.

2.1 Material Preparation

For the material preparation, there are several tools to take a description of each damage that occurs. Therefore, by using these tools, the field survey can be done more effectively.

First, crack width ruler as a measurement tool to determine the width of cracks in walls, floors, ceilings, and structural elements. It is an important instrument, as cracks that exceed specific limits may indicate serious structural movement or stress. Moreover, regularly monitoring the width of cracks over time allows for tracking the progression of defects and supports timely maintenance or repair actions.

Next, an infrared thermometer is also use as handheld device that measures surface temperatures using infrared radiation without requiring direct contact. It is useful for detecting temperature variations, which can be critical in identifying building defects such as moisture intrusion, inadequate insulation, or thermal anomalies caused by structural cracks. This tool is borrowed from Laboratory of Road Engineering Technology, UTHM Pagoh Campus to be able to conduct the field survey.

A smartphone helps for documenting the appearance and progression of building defects. Therefore, a standard mobile phone is utilized to capture high-quality images of cracks and other issues, enabling comparisons over time to observe any changes. These photographic records serve as valuable evidence for reporting and building maintenance documentation.

Lastly, a measuring tape helps assess structural cracks, paint peeling and mould measuring which is the measuring tape is used as a tool in order to be able to measure the length and width to know which categorized does the defects belong to. This measuring tape also are borrowed from Laboratory of Road Engineering Technology, UTHM Pagoh Campus.

2.2 Data Collection and Procedures

In this study, an on-site observational assessment will be carried out concurrently. Block A14 will undergo a systematically inspected floor by floor, covering all important areas and elements. The inspection will follow a standardized defect checklist to ensure that all potential defects are thoroughly identified and documented.

To start gathering data, the Block A14 are thoroughly inspected visually to determine any defects that are there. This process involves systematic walkthroughs to examine important structural, decorative, and functional components such as floors, walls, and ceilings. To ensure consistency, observations are recorded using standardized defect inspection checklists. Photographic evidence is also captured during inspections to document the types and quantities of defects for further analysis. Table 1 is field survey form is used to facilitate data collection and analysis of data results. To enable thorough examination, the defects are categorized into groups including cracks, peeling paint, termite infestation, water leakage and molds. This led to the formulation of a risk assessment matrix that assessed both the likelihood of the defects occurring and the severity of the potential consequences.

Table 1 *Field survey form*

LOCATION	DEFECT					DESCRIPTION	RISK ASSESTMENT MATRIX		
	CRACK	PEELING PAINT	MOLDS	TERMITE INFESTATION	WATER LEAKAGE		LIKEHOOD	SEVERITY	SCALE

Using the data that has been collected during the field survey, application of the Risk Assessment Matrix as shown in Table 2 which provide a thorough framework which analyse the likelihood and severity of potential maintenance issues [8]. A risk assessment matrix is a systematic tool used to identify the most critical risks to a program and offers a method for evaluating the potential impacts of these risks throughout the program's lifecycle [9]. It allocates resources more effectively, ensuring that the high-risk area receive timely maintenance by recognize the area that fall into the categories. These tools enabled the categorization of risks based on their likelihood of occurrence and the severity of potential consequences, allowing for a more structured assessment of maintenance requirements.

Table 2 *Risk assessment matrix*

Likelihood	Severity				
	Minor Injury	Non-reportable injury	Reportable Injury	Major Injury	Multiple Fatalities
Near certain	5	10	15	20	25
Probable	4	8	12	16	20
Possible	3	6	9	12	15
Unlikely	2	4	6	8	10
Remote	1	2	3	4	5

Then, the results of the completed survey will be incorporated into a rating form to evaluate common building defects. This helps in assessing the current condition of the building and provides supporting evidence through picture. By filling out the 'Description' columns, it can describe the level of disability according to the suitability of each defect. The 'level of disability will be divided into three levels which is high, medium and low based on the type of each defect.

The relationship between the rating form and the risk assessment matrix is likelihood and severity which determines the risk level for each defect. For example, the cracks with 'Probable' likelihood and 'Minor Injury' severity will fall in scale 4 which means that categories in 'Low' risk that will result in rating form.

3. Results and Discussions

From the Rating Form and Risk Assessment Matrix, a comprehensive assessment of 30 defects identified in Block A14 reveals the building's maintenance priorities. These defects are categorized into five main types, as summarized in Fig. 1, and further detailed in Table 4. Cracks, despite being largely low or medium risk, suggest potential structural concerns and require regular monitoring. Peeling paint and mold, although low risk, are indicative of possible moisture infiltration, necessitating preventive measures. The termite infestation, while currently low risk, demands immediate attention to avoid structural damage. Water leakages, with varying risk levels, also require timely repair to prevent escalation into mold growth or internal damage.

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Floor-by-floor analysis provides further clarity. On the first floor, 14 defects were identified, including 4 cracks one of which is deemed high risk due to its classification as a reportable injury and 2 water leakages, with one classified as reportable. Additionally, 4 cases of peeling paint and 2 mold incidents were noted, all associated with minor injuries. The second floor had a single mold incident classified as minor, suggesting reduced risk but an ongoing need for monitoring. The third floor presented 3 defects (2 cracks and 1 peeling paint), all deemed minor, yet warranting routine upkeep. On the fourth floor, 9 defects were documented, including 3 cracks and a termite infestation, all categorized as possible and minor injuries, though the cracks also qualified as reportable, indicating heightened risk and the need for immediate remediation. Finally, the fifth floor revealed 3 defects, including 1 crack (reportable injury) and 2 water leaks (minor injuries), again pointing to the urgency of targeted repairs. The defect was found in that location as shown in Fig. 2.

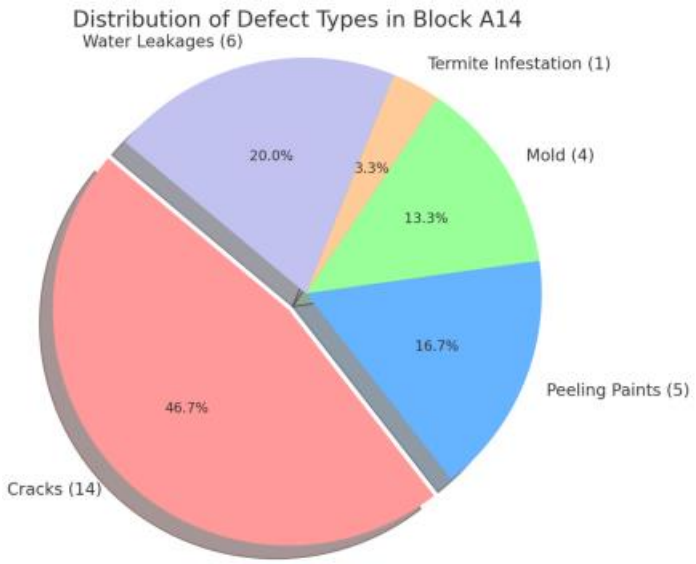

Fig. 1 *Pie chart of defect types identified in Block A14.*

Table 3 *Defects, Injury classification, Risk level and Action required*

Location	Types of defects	Injury classification	Risk Level	Action Required
First floor	Cracks	- Possible, Minor injury	- Low risk	Monitor regularly
	Peeling paint	- Possible, Minor injury	- Low risk	Moisture inspection is needed
	Molds	- Possible, Minor injury	- Low risk	Monitor closely
	Water leakage	- Possible, Minor injury	- Low risk	Routine inspection and repair
		-Probable, Reportable injury	-Medium risk	Prompt repair required
Second floor	Molds	-Possible, Minor injury	- Low risk	Monitor closely
Third floor	Cracks	-Possible, Minor injury	-Low risk	Monitor regularly
	Peeling paint	-Possible, Minor injury	-Low risk	Moisture inspection is needed
Fourth floor	Cracks	-Possible, Minor injury	-Low risk	Monitor regularly
		-Probable, Reportable injury	-Medium risk	Needs immediate attention
	Molds	-Possible, Minor injury	- Low risk	Monitor closely
	Termite infestation	- Possible, Minor injury	- Low risk	Urgent pest control
	Water leakage	- Possible, Minor injury	- Low risk	Routine inspection and repair
Fifth Floor	Cracks	-Probable, Reportable injury	-Medium risk	Needs immediate attention
	Water leakage	-Possible, Minor injury	-Low risk	Routine inspection and repair

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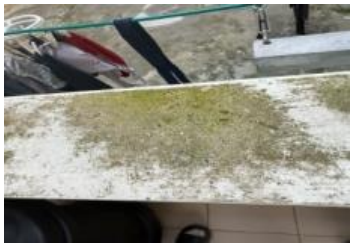
Cracks

Peeling paint



Molds

Water leakage

Terminate infestation

Fig. 2 *Types of defects*

4. Conclusion

The study successfully identified and documented 30 defects in Block A14 of the Residential College at UTHM Campus Pagoh. These defects were categorized into several types: cracks, water leakages, mold, peeling paint, and termite infestation. Using a rating form and risk assessment matrix, each defect was analyzed for its risk level and potential impact on building integrity and occupant safety. Immediate intervention is recommended for medium-risk defects, particularly cracks and water leaks. Low-risk issues should be monitored systematically to maintain the building's safety and functionality. The findings highlight the importance of addressing these defects to ensure long-term safety and comfort for occupants. Involving stakeholders in maintenance activities enhances the effectiveness of these efforts. When collaboration is lacking, the maintenance process can become inefficient. Overall, evaluating building maintenance is crucial for identifying effective practices that prevent hazards, ensuring the safety of building users, and addressing defects early to avoid similar issues in future constructions. These improvements are essential for achieving long-term goals related to safety and functionality.

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Conflict of Interest

Authors declare that there is no conflict of interest regarding the publication of the paper.

Author Contribution

This journal requires that all authors take public responsibility for the content of the work submitted for review. The contributions of all authors must be described in the following manner:

The authors confirm contribution to the paper as follows: ***study conception and design:*** *Anis Aisyah, Nur Izzah;* ***data collection:*** *Nur Izzah;* ***analysis and interpretation of results:*** *Anis Aisyah, Nur Izzah, Nurul Nasiha;* ***draft manuscript preparation:*** *Anis Aisyah, Nur Izzah, Nurul Nasiha, Nor Farah Atiqah Binti Ahmad. All authors reviewed the results and approved the final version of the manuscript.*

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