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THE DETERIORATION OF TIMBER MATERIAL IN TRADITIONAL MALAY HOUSE IN MALACCA

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ABSTRACT

This study explores the deterioration mechanisms affecting timber materials in traditional Malay houses in Malacca, Malaysia. These historic structures, predominantly constructed from high-quality tropical hardwoods, face various forms of damage driven by environmental factors, biological agents, and neglect. The investigation focused on three representative houses located in Kampung Morten, Kampung Duyong, and Kampung Durian Daun. Data collection involved observational surveys, defect documentation, and interviews with homeowners, revealing common decay types including termite infestation, fungal decay, surface weathering, and structural weakening. Analysis indicates that poor ventilation, elevated humidity levels, flooding, and insufficient preservation practices significantly accelerate timber degradation. The substantial impact of these factors underscores the vulnerability of these heritage buildings and highlights the lack of systematic conservation efforts. The findings emphasize the critical need for comprehensive preservation plans that incorporate improved ventilation strategies, moisture control, and active maintenance to mitigate decay processes. Furthermore, increasing occupant awareness about proper preservation techniques is essential to ensure long-term sustainability of these cultural assets. By providing an in-depth understanding of the causes and extent of timber deterioration, this research aims to inform and facilitate future conservation initiatives. Ultimately, the study advocates for integrated preservation approaches that combine structural, environmental, and educational measures to safeguard these traditional Malay houses, recognizing them as valuable elements of Malaysia's cultural heritage.

Keywords: Conservation, Malaysia, Termite damage, Timber deterioration, Traditional Malay houses

1. INTRODUCTION

Timber has long been valued for its fire resistivity, structural strength, and insulating properties, making it a vital material in construction. Modern advancements in wood processing and manufacturing have elevated the industry, positioning wood as a competitive alternative to steel and concrete. Innovations in wood technology now enable the construction of taller, larger-span, and more diverse structures than ever before. Despite these technological progressions, traditional wooden structures, such as Malay houses, face significant challenges relating to deterioration, primarily due to environmental and human factors.

The traditional Malay house is a crucial element of Malaysian cultural heritage, reflecting local values, ethics, and social identity. These houses serve not only as residences but also as cultural icons and tourism attractions, contributing to economic development. However, many are now at risk of decay caused by factors like neglect, environmental stress, and rapid

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modernization. Key structural elements including the roof, walls, beams, columns, and floors are vulnerable to defects such as rot, decay, and breakage (Latip et al., 2020).

There have been various conservation efforts, but these are often incomplete or unsatisfactory (Alsheikh Mahmoud et al., 2024). Therefore, a comprehensive, multi-perspective conservation approach—integrating engineering, economic, societal, and planning considerations—is essential for sustainable preservation. This study aims to assess current practices, identify issues, and propose strategies to enhance the conservation of these revered structures, ensuring their preservation for future generations.

2. LITERATURE REVIEW

A comprehensive review of existing literature is fundamental to underpinning academic research, offering critical insights into the scope, challenges, and progress within a specific field. However, in the context of traditional Malay house conservation and timber deterioration, there remains a lack of systematic and exhaustive reviews that synthesize current knowledge, practices, and gaps. This literature review categorizes different approaches—such as systematic, conceptual, and descriptive reviews—and examines their respective methodologies in studying heritage conservation, timber degradation, and cultural preservation (Snyder, 2019). It discusses issues related to defining the boundaries of relevant literature, differentiating between empirical studies and anecdotal evidence, selecting appropriate sources, and addressing biases inherent in various review methods. While systematic reviews aim to minimize bias through rigorous inclusion and exclusion criteria, they can inadvertently introduce new biases by excluding pertinent but unconventional studies, potentially hindering innovation and deeper understanding. This review emphasizes the importance of adopting comprehensive, multi-perspective review strategies that can effectively inform the conservation of Malay houses. By critically analyzing existing research paradigms, this section aims to establish a solid foundation for identifying gaps and informing future conservation strategies that are both culturally sensitive and scientifically robust.

2.1 Timber in Malay Houses

Timber has always been an important part of building Malay houses because it represents their culture and shows off their architectural skills. People usually chose local woods like Kelantanese teak, merbau, and other native hardwoods because they were strong, long-lasting, and easy to find. Because these species are naturally resistant to pests and decay, they are great for beams, columns, and walls. Using wood made it easier to design and build things in a variety of ways, and the intricate carvings and craftsmanship brought out regional styles, which added to the beauty of the buildings.

The natural qualities of wood, like its ability to insulate, its flexibility, and its warm look, have made Malay homes much more comfortable and long-lasting. But environmental threats and human factors are making it harder and harder for these benefits to last. The wood in traditional Malay houses can rot, get infested with termites, get wet, and be damaged by things like flooding and high humidity. These problems often make historic homes weaker, less stable, and eventually destroy them.

Modern treatments like chemical preservatives, kiln-drying, and engineered timber have become important parts of conservation efforts to fix these problems. But keeping traditional wooden buildings in good shape is still hard because it requires a careful balance between preservation, modernization, and cultural sensitivity. Urbanization and rapid growth put these historic buildings at even more risk, which often leads to neglect or random replacement.

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In the future, improvements in wood technology, like the creation of engineered timber and eco-friendly preservatives, hold a lot of promise for making wood last longer. To protect Malay houses as cultural treasures, it is important to raise awareness and put in place strong conservation policies. Combining traditional craftsmanship with modern technology in a way that is good for the environment could make wooden buildings last longer, so that future generations can enjoy their cultural and architectural value.

People in the area, even in rural and rural areas of Malaysia, still want wood for building. The 1970 statistics on homes in Peninsular Malaysia show how important wood was as a building material. About two-thirds of homes had wooden walls, 7.8% had a combination of bricks and boards, and 9.9% had bricks. Only 6.8% of homes were made of concrete.

These numbers also show that bricks and concrete are being used more and more as building materials. Wood is still a very popular building material, especially for homes and furniture, and it is still widely used in the construction industry. In bigger public and commercial buildings, the use of wood as hangers and layered layers also grew over time. Rain, frost, and acids that usually damage other materials don't hurt them.

Timber will only get worse if certain outside forces attack it. There are many reasons why wood fails, but if you take steps before, during, and after construction, you can avoid having to repair or replace it. Timber is still in high demand for construction today because it is strong, flexible, and looks good.

2.2 Defects on Timber

The timber of defect it can be repaired satisfactorily if the cause has been correctly diagnosed and identified. Correct diagnosis depends upon on the collection and analysis of all, information, knowledge of the characteristics and behaviour of bulling materials and methods of construction (Hashim, 2000).

According to Hashim (2000), the most common of the timber defects and the deterioration that occurred for the timber components of the traditional timber houses. The most common detect problem followed by insect attack and discoloration problems. Timber decaying organisms cannot be eradicated by pesticide treatments. The good maintenance is advisable to prevent the failure of building components especially for timber materials in traditional timber houses. It is more rational approach to the treatment of timber decay and should be promoted in the interest of sound building and public health.

Figure 1: Types of common defect on timber
Source: AfroHousePlans, 2022

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Wood deformities such as physical bleaching, excessive moisture content, dimension instability and chemical deterioration can also be grouped into the biological deterioration of calcium and biological deterioration caused by inertia in the organism itself (Hashim, 2000). Figure 1 illustrate type of timber defects.

Failures that commonly affect the wooden structures, a problem of tropical countries, are mainly related to water and biological attacks, such as termites, beetles, fungi of rot, common in the wood buildings. Disclosure that such environmentalists and pests are produced during use of this type of spectacles will be unnecessary in the future. During repair work, understanding why someone is disabled may be the best way to facilitate improvement. Indeed, the comprehension of causes and defect factors should be considered in a holistic sense. The repair job must be precisely done with the same type of defect and does not necessarily need to affect the aesthetic factor of a building (Md Azree Othuman Mydin, 2017).

2.3 Deterioration of Timber

In the past, traditional Malay buildings were mostly made of wood. These buildings show how standard building methods can be smartly changed to work in tropical areas. Even strong types of wood, like Cengal and Merbau, will break down because of environmental, biological, and human-made damage. This paper talks about what causes timber decay in traditional Malay buildings, how to fix it, the issues it causes, and how to protect it. It does this to stress the necessity for a permanent conservation program. Timber is the main material used to build traditional Malay houses since it is easy to get and works well in the local climate. Cengal is very resistant to rot and termites, making it a great choice for structural elements (Ahmad, 1994).

As non-structural parts, merbau and meranti are more likely to break down in the environment and by living things. Scholars refer to the intricate jointing and raised floor patterns that traditional Malay builders used to protect the wood from moisture and termites as examples of their skill (Shamsuddin, 2011). But even the greatest wood can be damaged by time, especially if you don't take care of it when it's new or while it's in use.

The breakdown of wood in traditional Malay buildings is a complicated issue caused by a mix of environmental, biological, and human-made elements. These risks put these cultural markers in peril, which is another reason why a preservation effort should happen. To protect these kinds of buildings for future generations, the best ways to stop them from falling down, fix them, and get people involved must all come together. Traditional Malay houses are more than just old buildings; they show how Malaysians live and how resourceful they are. In addition to protecting their heritage, they require money to invest in principles of sustainable architectural conservation in order to survive.

Timber has always been an important part of building Malay houses, representing cultural uniqueness and architectural creativity. People usually chose local woods like Kelantanese teak, merbau, and other native hardwoods since they were strong, long-lasting, and easy to find. Because these species are naturally resistant to pests and decay, they are great for building things like walls, beams, and columns. Using wood not only made design and construction more flexible, but it also added to the building's beauty, with beautiful carvings and workmanship that showed off regional styles.

The natural qualities of wood, like its ability to insulate, bend, and seem warm, have made Malay homes much more comfortable and long-lasting. But environmental risks and human causes are making it harder and harder for these benefits to last. The wood in traditional Malay houses can rot, get infested with termites, get wet, and be damaged by things like flooding and

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high humidity. These problems often make ancient homes weaker, less stable, and eventually destroy them.

Modern treatments like chemical preservatives, kiln-drying, and engineered lumber have become important parts of conservation attempts to fix these problems. But keeping historic wooden buildings in good shape is still hard because it requires a delicate balance between preservation, modernity, and cultural sensitivity. Urbanization and rapid growth put these historic buildings at even more risk, which often leads to neglect or random replacement.

In the future, improvements in wood technology, including the creation of engineered timber and eco-friendly preservatives, hold a lot of promise for making wood last longer. It is important to raise awareness and put in place rigorous conservation policies to make sure that Malay houses stay cultural treasures. Combining traditional skill with modern technology in a way that is good for the environment could help timber buildings last longer, so that future generations can enjoy its cultural and architectural value.

3. METHODOLOGY

For this study, studies have been conducted on the traditional Malay houses to find a defect on timber that covers some of the areas around Melaka. The selection of this study is based on the deterioration of timber material in traditional Malay House. The data collected through observation, defect assessment and interviews with owners. The qualitative data is analysed and conclusion is derived.

3.1 The Case studies

House 1: Kampung Morten

Kampung Morten is a traditional kampung in the heart of Melaka and within the boundary of the World Heritage Site buffer area. It is well known as a traditional village with Malaka House and often being the tourist destination. Figure 2 show the streetscape of Kampung Morten across Sungai Melaka.

Figure 2: Kampung Morten

The selected case study has an open front veranda, elevated timber floors, and a pitched roof, all of which are characteristics of traditional Malay architecture. It blends style and functionality, and its raised design and natural ventilation ensure comfort in tropical climate. The building is mostly made of wood, and the roof is made of zinc. Concrete footings, a contemporary addition for structural stability, support the floors and columns (Figure 3: House 1).

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Figure 3: Case Study House 1 front profile

Figure 4: Left Elevation House 1

House 2: Kampung Duyong

Kampung Duyong is one of the oldest villages in Malacca, known for preserving traditional Malay architecture. The house reflects the traditional Malay house style with a gabled roof, wide front veranda (serambi), and elevated floor supported by timber posts.

House 2 is an example of renovated traditional Malay House. The design promotes natural ventilation and reflects traditional Malay craftsmanship. The main materials used are timber for the structure and walls, with clay roof tiles or zinc sheets for the roof. The veranda area incorporates ceramic tiles and decorative concrete elements. The house appears to be in well-maintained condition, still inhabited and renovated for comfort while retaining its traditional charm. Some modern upgrades are visible, especially in the outdoor space and floor tiling.

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Figure 5: Front Elevation of House 2

House 2 features many intricate carvings in the railings and verandah area (Figure 6). This combination of old and new material helps to sustain the building for a longer usage.

Figure 6: Timber railing with carvings.

House 3: Kampung Durian Daun

Figure 7: The Front elevation of House 3

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This selected case study is one of the few traditional Malay architectural buildings still intact in the Melaka. Its use of natural building materials and tropically appropriate architecture represent the traditional lifestyle of the Malay community, giving it important heritage significance. The main building materials are cengal and meranti timber, which are both renowned for their resilience to weather and insects. The roof's original thatched roofing may have been replaced by zinc or clay tiles. The house is still standing, although it has deteriorated, especially the timber structures that have been exposed to the elements and termite infestation. infestation. Currently, a portion of the house is utilized for both residential and small-scale business activities.

Figure 9: Left elevation of House 3

Figure 9: Right elevation of House 3

This study uses qualitative investigation into the deterioration of timber materials in traditional Malay buildings. The methodology comprised comprehensive interviews with stakeholders, specifically the homeowners. Semi-structured interviews and focus groups are undertaken to examine participants' experiences and perceptions regarding the causes and progression of timber degradation. Participants contribute significant information regarding maintenance, environmental concerns, traditional construction, and the protection of timber structures, as well as timber-related environmental and conservation issues. They gather observational data by traversing historic dwellings and documenting apparent indicators of deterioration, decay, and the repair process. This methodology seeks to enhance understanding of the socio-cultural and practical ramifications of wood decay, which is essential for long-term conservation.

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4. RESULT AND DISCUSSION

The interviews with three traditional Malay houses provide insights about the homeowners, the state of the dwellings, and the maintenance practices implemented. In addition to the interview, a visual examination was conducted to determine the extent and severity of the degradation. The outcome is recorded and examined. The interview questions incorporate notes from the visual evaluation.

House 1 is owned by a 54-year-old homemaker, and accommodates five residents. The house, composed of wood and concrete, is 70 years old and was completed in 1958. Many of the changes are superficial, with the restroom, kitchen, and secondary living area transformed into concrete. Commonly identified flaws include termite infestation, discoloration of vermis, sogs, and moisture. Figure 10 and 11 shows the condition of the timber. The owner maintains the house by applying a fresh coat of oil paint or varnish and administering insecticide every fortnight. The land on which the home is situated is susceptible to rain and sunlight, rendering it a risk for deterioration.

Figure 10: The termites attack and decaying external structure of House 1

Figure 11: The internal condition of the house showing column and joins decay

House 2 comprises a nine-member household, which includes 73-year-old retired educator. The house, aged 60 years, was constructed from timber and concrete. The sole renovation executed was the replacement of the toilet with a concrete one. The issues include termite infestation, wood decay, and visible cracks in the structure (Figure 12) To address these issues, the owner annually applies oil paint to the structure and

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administers insecticide every three months. Similar to House 1, this residence is excessively exposed to rain and sunlight.

Figure 12:The structural decay of roof beam (left) and column (right) is the major defect for House 2

House 3 is owned by a 45-year-old housewife, and accommodates 9 residents. The house was built in 1945, rendering it 80 years old, the oldest of the three residences. The structure comprises timber and concrete, with a concrete kitchen installed during renovations. The building exhibits several issues, including paint varnish degradation, termite infestation, timber decay, moisture intrusion, and structural cracking. The termites attack has affected the structural integrity of the building (Figure 13 and 14). The homeowner will appreciate that the original appearance can be reinstated through repainting or varnishing with oil-based products. This house, like other residences, is subjected to weather elements such as rain and sunlight.

Figure 13:The decay in floor boards and joist impacted the structural condition of house 3

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Figure 14: Termites attack at the column and floor boards

Figure 15 describe causes led to decay of the three houses. The deterioration of Malay houses results from a complex interplay of structural vulnerabilities, environmental influences, and maintenance practices. Structural issues, such as the intrinsic weaknesses in the building's framework, can be exacerbated by biological attacks like termite infestation and natural processes like wood decay. These biological factors weaken the structural integrity of the house over time, making it more susceptible to damages.

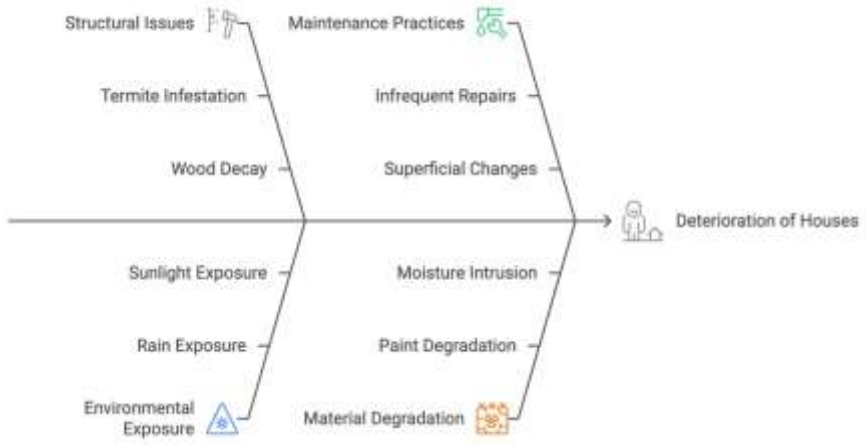

Figure 15: Causes of defects that lead to deterioration of the three houses

Environmental exposures—such as prolonged sunlight, rain, and general weather conditions—accelerate material degradation by causing surface wear, paint erosion, and moisture ingress. Sunlight exposure can cause cracking and fading of surface finishes, while rain and humidity facilitate moisture penetration, leading to rot and fungal growth. These environmental stresses, in combination with biological deterioration and a lack of proper maintenance, significantly contribute to the progressive damage of the house.

Maintenance practices play a crucial role in either mitigating or accelerating deterioration. Infrequent repairs, superficial surface treatments, and neglect in addressing early signs of damage allow issues to compound. Moisture intrusion, if not promptly managed, leads to further decay of timber and structural components, while superficial changes that do not address the underlying issues result in ongoing material degradation. Poor maintenance and repair practices thus significantly influence the rate at which these traditional houses deteriorate.

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Overall, the combined effects of environmental exposure, biological attack, and suboptimal maintenance practices are primary drivers of the long-term deterioration observed in Malay houses, emphasizing the need for integrated preservation strategies.

5 CONCLUSION

The findings from the study indicate significant structural deterioration in the timber components of the traditional Malay house. Evident issues include extensive wood decay, surface erosion, and possible termite damage, which compromise the integrity and safety of the structure. The signs of deterioration, such as the worn surfaces, visible splitting, and potential pest infestation, highlight the urgent need for targeted conservation and repair measures. These damages not only threaten the longevity of the heritage structure but also reflect the adverse impacts of environmental exposure, insufficient maintenance, and biological attacks. These damages corroborate the study's conclusion that environmental factors such as moisture, humidity, and inadequate maintenance significantly accelerate timber degradation. The extent of deterioration underscores the necessity for systematic conservation strategies, including targeted treatment and regular monitoring, to mitigate ongoing damage. Addressing these issues through modern preservation techniques is imperative to sustain the structural integrity and cultural significance of Malay houses, as emphasized in the overall research aims to facilitate effective conservation practices grounded in a comprehensive understanding of the causes and extent of timber decay.

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