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WELCOME SPEECH FROM THE CHAIRMAN

RISM 17th International Surveying Conference for Undergraduates (ISCU 2025)

بسم الله الرحمن الرحيم السلام

عليكم ورحمة الله وبركاته

Greetings to all,

It is with great pleasure that I welcome you to the 17th RISM International Surveying Conference for Undergraduates (ISCU 2025), themed *"Embracing Construction Revolution 4.0: Transforming Malaysia's Built Environment."* On behalf of the Royal Institution of Surveyors Malaysia (RISM), I also wish to express our sincere appreciation to Universiti Teknologi MARA (UiTM), Perak Campus, for graciously hosting this significant event.

As we navigate the era of the Fourth Industrial Revolution (IR4.0)—or in our context, Construction Revolution 4.0 (CR4.0)—we are witnessing transformative advancements across the global construction sector. Technologies such as Building Information Modelling (BIM), the Internet of Things (IoT), artificial intelligence (AI), robotics, big data analytics, and cloud computing are redefining the way we build, manage, and interact with our built environment. For Malaysia, embracing CR4.0 is a strategic imperative to achieve our socio-economic and environmental goals.

This conference serves as a vital platform to unite surveying undergraduates from various disciplines, fostering critical dialogue on industry challenges, enhancing professional networking, and preparing a new generation of talent for the rapidly evolving construction landscape. It is also an opportunity for employers to engage with and inspire our future professionals.

I would like to extend my heartfelt thanks to all industry speakers, paper presenters, judges, and participants for their time, contributions, and support in making ISCU 2025 a success. I also commend the organising committee for curating a meaningful and dynamic conference experience.

May the knowledge gained, connections formed, and ideas exchanged during this event inspire all participants to lead and innovate in their future endeavours.

Wishing everyone a productive and memorable conference.

Prof. Ts Sr Dr. Adi Irfan Bin Che Ani'
Chairman, Universities' Partnering Committee
RISM Session 2024/2025
May 2025

WELCOME SPEECH FROM CO-CHAIRMAN

RISM 17th International Surveying Conference for Undergraduates (ISCU 2025)

Bismillahirrahmanirrahim.

السلام عليكم ورحمة الله وبركاته and greetings to all.

It is my great pleasure to welcome everyone to the 17th International Surveyor Conference for Undergraduates (ISCU 2025), proudly hosted by Universiti Teknologi MARA (UiTM) Perak Branch in collaboration with the Royal Institution of Surveyors Malaysia (RISM). This event is a meaningful platform for students in the built environment to share ideas, showcase innovations, and build professional networks. We are honoured by your presence and enthusiastic participation, with 135 accepted papers and 78 poster presentations this year.

UiTM Perak, home to the College of Built Environment, has long been a hub for academic excellence in architecture, planning, and surveying. Our commitment remains strong in nurturing competent graduates who meet industry demands and contribute to nation-building.

While you're here, we invite you to experience the heritage and culture of Perak Tengah from the architectural richness of Rumah Kutai to the historical towns of Pasir Salak, Bota, and Kampung Gajah.

To all presenters and winners, congratulations on your achievements. Let your work today be a catalyst for future success and academic growth. We hope this conference will inspire you to explore new ideas, foster collaboration, and make lasting memories.

My deepest thanks to the Royal Institution of Surveyors Malaysia (RISM) and the organising committee for making this event a success.

We hope your experience here will be rewarding and unforgettable.

Thank you. Selamat datang dan selamat berjaya.

Associates Professor Dr. Nur Hisham Ibrahim, *PMP*
Co-Chairman, Universities' Partnering Committee
RISM Session 2024/2025
May 2025

WELCOME SPEECH FROM THE PROJECT DIRECTOR

RISM 17th International Surveying Conference for Undergraduates 2025

Alhamdulillah, all praise to Allah S.W.T. for His guidance and blessings in making the RISM 17th International Surveying Conference for Undergraduates (ISCU) 2025 a reality.

It is with great honour and gratitude that I welcome all participants, guests, academicians, and industry professionals to this prestigious event, proudly organized under the Royal Institution of Surveyors Malaysia (RISM). This 17th edition of ISCU stands as a proud testament to our collective dedication toward academic excellence, professional collaboration, and youth empowerment in the field of surveying.

I extend my heartfelt appreciation to RISM for its unwavering support, to the hardworking ISCU 2025 Organising Committee, and to all 16 partnering universities across Malaysia for their commitment and contributions. Your efforts have shaped this conference into a dynamic platform for knowledge exchange, innovation, and professional growth.

To the academicians and practitioners present, your insights are invaluable in bridging the gap between academic theory and real-world practice. To our undergraduate participants, your passion, curiosity, and commitment are the very foundation of our future. May this conference not only deepen your academic journey but also ignite a spirit of leadership, integrity, and sustainable thinking.

Let this gathering serve as more than an academic milestone. May it foster lifelong networks, inspire transformative ideas, and chart new directions in our shared professional journey.

Wishing everyone a rewarding and inspiring conference experience.

Sr Dr. Nurul Fadzila Zahari
Project Director
RISM 17th ISCU 2025

IMPACTS OF MALAYSIA'S CLIMATE ON WALL MATERIAL DETERIORIATION IN RESIDENTIAL HOUSING: A COMPARATIVE STUDY OF CONSTRUCTION ERAS IN PRE-WAR (1900-1940), POST WAR (1980-1990) AND MODERN (EARLY 2000S) IN WALL MATERIAL DEFECT

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ABSTRACT

Malaysia's tropical climate characterized by high humidity, heavy rainfall, and fluctuating temperatures poses significant challenges to the durability and performance of wall materials in residential buildings. This study investigates the impact of climatic conditions on external wall material deterioration across three construction periods: Pre-War (1900–1940), Post-War (1980–1990) and Modern (early 2000s). The main objectives are to identify common wall defects, evaluate their severity and determine the influence of environmental factors on material degradation over time. A mixed-method approach was employed, combining visual inspections of residential buildings with interviews involving building surveyors, homeowners and conservation specialists. The study focuses on four primary types of wall deterioration: cracking both structural and temperature-related, moisture penetration caused by rain, condensation and waterproofing failure, biological growth such as mold and algae from persistent humidity and surface erosion due to long-term exposure to moisture and pollutants. The results indicate that each construction era presents distinct vulnerability patterns influenced by the materials and techniques used. Pre-War buildings often experience biological growth and surface erosion due to their porous wall construction, though they maintain good structural integrity. Post-War structures show more pronounced cracking and water ingress issues, likely due to the use of less permeable but more brittle materials. Meanwhile, Modern buildings encounter frequent deterioration caused by poor workmanship, faster ageing of synthetic materials and minimal tolerance to moisture fluctuations. This comparative analysis illustrates both the progression and limitations of wall construction practices over time. The study underscores the urgent need for climate-resilient construction strategies, effective material choices and preventive maintenance measures. The findings contribute valuable insights for building surveyors, conservationists and policymakers in formulating sustainable residential building practices and enhancing heritage preservation efforts in Malaysia's tropical environment.

Keywords: Wall Material Deterioration, Climate Impact, Construction Eras, Residential Housing, Building Defects

I. INTRODUCTION

The relationship between climate and building materials is an increasingly important area of study particularly in regions with distinctive and challenging weather patterns such as Malaysia. As a tropical country located near the equator Malaysia experiences a combination of high temperatures, high humidity and significant rainfall throughout the year which profoundly affects the durability, performance and lifespan of construction materials. Malaysia poses significant challenges for the building industry as it accelerates material deterioration, affects structural integrity and impacts maintenance needs. This relationship between climate and building materials becomes even more complex when considering the different construction methods and materials used throughout various historical periods. From the traditional timber houses designed for passive cooling to the more modern concrete-based buildings. Each period has developed its own strategies to adapt to the tropical climate, yet each faces its own set of challenges.

Malaysia's geographical location near the equator means it experiences relatively stable weather patterns with an average annual temperature of approximately 27°C and relative humidity levels frequently exceeding 80% (IPCC, 2021). The combination of high temperatures and humidity leads to thermal expansion and contraction in construction materials which can cause cracking, warping and other forms of degradation. Additionally, Malaysia's tropical climate is marked by seasonal rainfall with particularly intense monsoon seasons and frequent tropical storms. These conditions contribute to excess moisture accumulation which further accelerates material breakdown and increases the risk of water infiltration, leading to further deterioration of exterior wall of buildings.

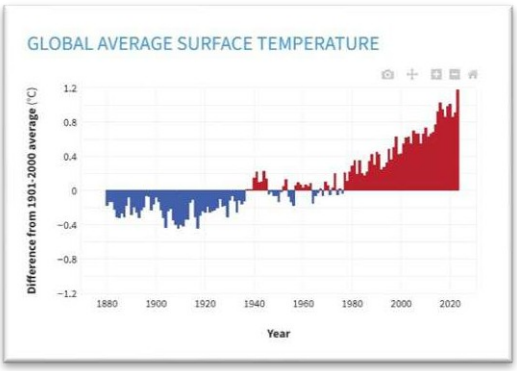

Figure 1.0: Yearly surface temperature from 1880–2023.
Source: Science And Information for a Climate Smart-Nation

The data in Figure 1.0 shows that global surface temperatures have increased significantly since the late 19th century with the warming trend speeding up in recent decades. The rising temperatures and their effect such as higher humidity and heavier rainfall put more stress on building materials especially in Malaysia's tropical climate. The roughly 1°C rise in global temperatures since the pre-industrial era has major effects on buildings in Malaysia. As a tropical country, Malaysia already faces hot and humid weather along with frequent heavy rains. Global warming makes these conditions worse causing problems like faster wear and tear of building materials (IPCC, 2021).

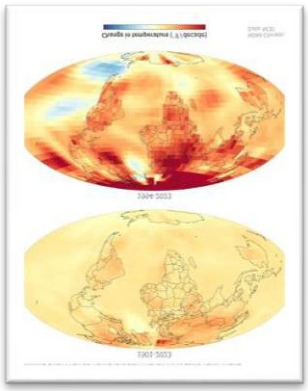

Figure 2.0: Trends in annual surface temperature in the past few decades (1994-2023) & the 20th century (1901- 2023)

The Figure 2.0 shows the global surface temperature has been rising rapidly especially in recent decades. Between 1994 and 2023, the rate of warming has been much faster compared to 1901. In some areas, temperatures are increasing by more than 1°F per decade with the most significant warming observed in the Arctic. This region is warming faster because the loss of ice and snow which normally from sunlight and exposes darker surfaces that absorb more heat to further increasing temperatures (NOAA National Centers for Environmental Information, 2024).

These conditions accelerate material deterioration causing issues like moisture infiltration, corrosion, cracking and biological growth. The challenge becomes more complex when considering how different construction eras respond to this environment. Traditional timber houses offered passive cooling but are vulnerable to rot and pests. Post-war buildings adopted cement and concrete but still suffer from surface damage and cracking. Meanwhile,

modern constructions using advanced materials face issues like reduced lifespan and poor workmanship under increasing climate stress. Global warming has intensified these challenges, increasing rainfall and temperature extremes, further weakening building materials especially in coastal areas. This study compares wall material deterioration in Malaysian houses from three construction periods: Pre-War (1900–1940), Post-War (1980–1990) and Modern (2000s), aiming to identify vulnerabilities and improve future building resilience. Understanding these climate-material interactions is crucial for enhancing housing durability, guiding maintenance strategies and supporting sustainable construction in Malaysia's changing environment.

Table 1.0: Comparative analysis of the wall materials used across different construction eras in Malaysia

Construction Era	Common Wall Materials	Climate Response	Durability in Tropical Conditions
Pre-WWII (Before 1945)	Timber planks, wooden frames	Naturally ventilated, raised floors, good runoff design	Moderate to High – prone to termite attack but good for moisture control
Post-war to 1980s	Clay bricks, cement render	More solid walls but limited insulation and moisture control	Moderate – can trap humidity, susceptible to mold
1990s–2010s (Modern Era)	Reinforced concrete, lightweight blocks	Better strength but often sealed envelopes increase humidity retention	Low to Moderate – cracking and mold common if poorly ventilated
Current (2010s onward)	Composite panels, IBS, AAC blocks	Improved insulation and design, use of coatings and sealants	High – if proper maintenance and design is applied

Based on Table 1.0, Malaysia's construction practices have evolved significantly across different eras influencing how wall materials perform in the tropical climate. Before 1945, Pre-WWII houses commonly used timber planks and wooden frames. These structures featured raised floors and natural ventilation, allowing for effective moisture control, though they were moderately to highly durable only if termite infestations were managed. In the Post-War period up to the 1980s, clay bricks and cement render became popular. While these provided more solid walls, they had limited insulation and moisture control, making them moderately durable but vulnerable to trapped humidity and mold growth.

From the 1990s to the 2010s, modern houses adopted reinforced concrete and lightweight blocks. Although these materials offered better strength, their sealed construction often retained humidity, which reduced durability and made them prone to cracking and mold, especially when ventilation was inadequate. In the current era (2010s onward), advanced materials such as composite panels, Industrialized Building System (IBS) components, and Autoclaved Aerated Concrete (AAC) blocks are widely used. These materials, combined with improved insulation, coatings, and sealants, show high durability in tropical conditions—provided that proper maintenance and design practices are consistently applied.

Problem Statement

Malaysia's tropical climate characterized by high humidity, heavy rainfall, and temperature fluctuations poses significant challenges to the durability and performance of construction materials especially external wall materials in housing. These environmental conditions accelerate material degradation, impacting the structural integrity and lifespan of buildings. Although prior research has explored the general effects of tropical climates, there is a knowledge gap in understanding how Malaysia's specific climate influences wall deterioration across different historical construction periods.

Materials have evolved from traditional timber (pre-WWII) to concrete and composite systems (modern era), each with varying resistance to climate-induced damage. Factors such as mold growth, wood rot, metal corrosion, cracking due to thermal expansion and water infiltration are especially prevalent in walls exposed to prolonged moisture and poor design. Older timber houses, designed for ventilation and runoff often perform better under humid conditions than some modern buildings, which are more prone to moisture and thermal-related failures if maintenance is lacking. With climate change intensifying rainfall and temperature variations, wall degradation is expected to worsen, increasing repair and maintenance costs. Therefore, this research aims to identify climate-related wall defects in Malaysian housing from different construction eras, providing insights to enhance material selection, construction practices, and sustainability strategies for future housing.

Research Questions

This study is dealing with the following research questions:

1. How do temperature fluctuations and prolonged exposure to humidity impact external wall materials like timber, brick and modern composites used in Malaysian housing?
2. How do Malaysia's tropical climatic conditions such as humidity, rainfall and temperature fluctuations affect the external wall deterioration of building materials used in housing?
3. What is the most common climate-related defects observed in houses built during the pre-WWII period, post-war era and modern times in Malaysia?

Research Aims

The aim of this research is to examine the impact of Malaysia's tropical climate on the external wall deterioration of materials used in housing across different construction periods.

Research Objectives

The following objectives are formulated to achieve the aim of this study is to achieve the aim and answers the research objectives, here are the research objectives:

1. To examine how tropical conditions impact different external wall materials.
2. To analyse the climatic factors affecting the external wall deterioration of building materials in Malaysia's housing
3. To identify and categorize the most common climate-related defects observed in houses built during different era.

Significance Of Study

This study addresses key challenges related to building material durability in Malaysia's tropical climate. By examining external wall deterioration across different construction periods. It offers insights into how humidity, rainfall and temperature impact materials like timber, brick and modern composites leading to issues such as cracking, corrosion and mold. The findings are valuable for guiding architects, engineers and contractors in choosing climate-resilient materials and suitable construction techniques. They also support better maintenance strategies, helping reduce repair costs and extend building lifespan. Additionally, the study promotes sustainable construction by identifying eco-friendly materials and practices, aligning with environmental goals. It also aids heritage conservation by recommending appropriate restoration methods for older buildings, ensuring structural integrity while preserving cultural value. In summary, this research helps improve housing durability, supports sustainability and enhances resilience in Malaysia's construction and heritage sectors.

Scope of Research

i. The scope of the residential buildings will be focused on land housing that were built in different eras from pre-war (1900-1940), post war (1980-1990) and modern (early 2000S).
ii. The scope of research will be focused on the data humidity and the rainfall which are one of the factors of climate change. The site analysis will be conducted to find out what are the defects that they have in those buildings.
iii. The statistical data from Jabatan Meteorologi and other sources will be used to know the differences between the humidity and rainfall that have in those specific era from pre-WWII period, post-war era and modern times in Malaysia.
iv. The on-site observation and interviews will be conducted with the homeowners, experts and the property management to gain more information and knowledge regarding the history of the buildings and the way they are maintained.

II. LITERATURE REVIEW

Malaysia's tropical climate characterized by high humidity, frequent rainfall and temperature fluctuations significantly affects the performance and durability of building materials particularly those used in housing walls. Over time, these environmental conditions accelerate material degradation, compromising the structural integrity and longevity of buildings. While existing research has addressed the general effects of tropical climates on building materials, there is a gap in understanding how Malaysia's specific climate influences external wall

deterioration across different construction periods. This literature review aims to explore the relationship between Malaysia's climate and external wall material deterioration with a focus on the effects of moisture, heat and humidity as well as construction practices across various eras.

Several environmental and mechanical factors contribute to external wall material deterioration in Malaysia's tropical climate.

- **Moisture-related Damage**: One of the most significant contributors to external wall deterioration in Malaysia is moisture damage. High humidity levels and frequent rainfall lead to the infiltration of water into external walls causing issues such as mold growth, efflorescence and weakened mortar or plaster. Water infiltration often results from poor drainage systems, leaking roofs or faulty plumbing leading to extensive damage if left untreated (Building and Construction Authority, 2013). To mitigate these issues, it is crucial to maintain proper drainage systems and use waterproof coatings on wall surfaces.
- **Thermal Expansion and Cracking**: Malaysia's tropical heat contributes to the expansion and contraction of building materials leading to thermal cracking. This is particularly prevalent in materials such as concrete and mortar which are commonly used in modern buildings. Over time, these cracks can accumulate moisture further exacerbating deterioration. For example, heat can cause the paint on external walls to peel and in some cases, it can cause plaster to weaken and crack making the building vulnerable to further damage (Tang, 2019).
- **Moisture and Structural Movement**: The shifting of the foundation particularly in areas prone to heavy rainfall and flooding can lead to cracks in the external walls. When the foundation settles or moves, it can cause significant stress on the walls leading to misalignment, cracks and even sagging. This structural movement is often accelerated in tropical climates due to soil erosion and moisture penetration further damaging the building's integrity (Neville, 2000).

The choice of materials plays a critical role in determining how well a building performs under Malaysia's tropical conditions.

- **Traditional Timber Houses**: Older timber houses often designed with natural ventilation and runoff systems tend to perform better in humid conditions than modern buildings. Timber's porous nature allows it to absorb moisture which can result in wood rot, mold and pest infestations. However, in well-ventilated spaces timber can release moisture more effectively preventing some of the more severe damage seen in modern buildings (Gowers, 2015). This is especially true for houses built before WWII where the design accounted for the need for airflow and moisture dissipation.
- **Modern Concrete and Composite Materials**: Modern buildings constructed predominantly with concrete and composite materials are more vulnerable to moisture and heat damage if proper maintenance is not maintained. Concrete while durable can crack due to thermal expansion and water infiltration. Inadequate waterproofing and drainage systems often result in significant damage over time. Additionally, composite materials like gypsum boards used for their cost-effectiveness are prone to damage from moisture leading to mold growth and weakening of the walls.

Regular maintenance and the correct selection of materials can significantly reduce the rate of deterioration.

- **Sealing and Waterproofing**: Regular checks for water damage and the application of waterproof coatings can significantly mitigate moisture-related deterioration. Waterproofing systems including sealants and water-resistant coatings help protect wall surfaces from the adverse effects of constant moisture exposure (Smith, 2010). For example, ensuring that external walls are properly sealed and that rainwater drainage is efficient can prevent water from infiltrating the external walls and weakening the structure.
- **Regular Inspections and Structural Reinforcement**: For buildings constructed in the mid-20th century and beyond, regular inspections by structural engineers are necessary to identify signs of foundation movement or moisture damage. Reinforcement techniques such as underpinning and stabilizing foundations may be required to prevent further deterioration and maintain the building's structural integrity (Stern, 2017).
- **Proper Ventilation and Climate Adaptation**: Ensuring that the building's ventilation system is adequate is essential for maintaining a healthy indoor environment and reducing the risks of mold growth and material decay. Furthermore, using materials suited to the tropical climate such as moisture-resistant coatings and durable materials for exterior walls can significantly improve the building's resilience to environmental stresses.

III. RESEARCH METHODOLOGY

The study utilizes a mixed-method approach, combining both qualitative and quantitative methodologies. This dual approach provides an in-depth analysis, addressing not only numerical data on building defects but also contextual insights on how climate-specific factors impact materials.

- Qualitative Aspect: Focused on observations, interviews with property owners, and visual inspections to understand the nature of material defects.
- Quantitative Aspect: Statistical evaluation of defect frequency and severity across different construction periods to identify trends and correlations.

Data Collection Method

1. Primary Data:

Data was obtained through on-site building inspections with a specific focus on external wall residential properties. Each defect was categorized by type, severity and potential causes linked to climate-related factors such as high humidity, temperature fluctuations or rainfall exposure. Defects were photographed and detailed notes were recorded to ensure consistency in data collection.

2. Secondary Data:

Secondary sources, including government publications, construction industry reports, academic articles, and case studies, were reviewed to support the analysis. These sources provided valuable background information on Malaysia's climatic conditions, construction standards, and common material defects.

Sampling Strategy

The sampling strategy was designed to ensure diversity and relevance in the selected housing units:

- **Purposive Sampling**: Residential buildings were chosen based on construction era pre-1980, post 1980- 2000, modern 2000s to analyse how material performance has evolved over time.
- **Geographical Scope**: Houses in areas prone to high humidity, heavy rainfall, or prolonged sunlight exposure were prioritized.
- **Sample Size**: A minimum of 1 house from each construction period were inspected to ensure adequate representation and comparability

Analythical Method

1. Qualitative Analysis:

Observation reports and photographs were reviewed to identify recurring defect types and their relationship to environmental conditions. Descriptive narratives were developed to explain how specific climatic factors, such as tropical storms or humidity, accelerate material deterioration.

2. Quantitative Analysis:

- Data on defect occurrence, severity, and repair frequency were quantified and analyzed statistically.
- Correlation and regression analyses were performed to identify patterns between defect trends, climatic factors, and construction eras.
- Results were tabulated and visualized using charts and graphs to highlight key findings.

CONCLUSION

This research contributes to a deeper understanding of how Malaysia’s tropical climate influences the deterioration of wall materials in residential buildings from different construction eras. By comparing Pre-War, Post-War and Modern houses, the study reveals critical insights into material performance, vulnerability and resilience under persistent climatic stressors such as humidity, rain and biological growth. These findings are particularly relevant to building professionals involved in heritage conservation, sustainable housing design and construction quality improvement.

Future work could build upon this comparative framework by incorporating additional building elements or by using advanced diagnostic tools to monitor deterioration over time. Furthermore, the study’s outcomes may

inform policy recommendations for climate-responsive construction practices and promote the development of standards that prioritize durability and low-maintenance materials in Malaysia's housing sector.

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