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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

EVALUATION OF FIRE RISK ASSESSMENT IN HERITAGE MUSEUM BUILDINGS USING UNIFORM BUILDING BY-LAWS (UBBL) 1984

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ABSTRACT

The purpose of this study is to investigate the fire risk assessment requirements in heritage museum buildings. This research opted to use qualitative methods on three selected National Heritage Buildings (gazetted under National Heritage Act, 2005). Purposive sampling from secondary sources is used to evaluate the risk of fire in historic museum buildings. The findings of this research are to improve the level of safety of the heritage museum buildings and with the implementation of fire safety requirements. This research is limited to three heritage museum building listed as National Heritage Act 2005 in the Kuala Lumpur region. This research investigates by assessing and improving PART VII and Part VIII from Uniform Building By-Laws (UBBL) 1984, heritage museum can be better preserved, reducing the risk of fire damage or destruction and protecting invaluable artifacts, documents and cultural heritage housed within these buildings. The research social implications include by implementing effective fire protection measures it can ensure the safety of tourists and staff and helps maintain uninterrupted access to these attractions, preserving their appeal and economic contribution to the tourism sector especially for future generations of visitors to enjoy and learn. This research originality focuses on balancing fire safety and historical preservation in heritage buildings using both passive and active fire protection systems. The study helps to ensure these buildings remain safe, legally compliant and eligible for government support while preserving their historical value.

Keywords: Fire Risk Assessment, Fire Safety, Uniform Building By-Laws (UBBL) 1984, Heritage Buildings, Museums

I. INTRODUCTION

Cultural heritage influences our identity, provides capabilities, and reveals vulnerabilities; however, the value and vulnerability of cultural heritage are largely absent during conventional risk assessments (Crowley, et al., Cultural heritage and risk assessments: Gaps, challenges,and future research directions for the inclusion of heritagewithin climate change adaptation and disaster management, 2022). Research into fire risk assessment in heritage museum buildings is to ensure that heritage museums remain safe spaces where the public will be able to experience and learn from this invaluable historical resource. Kuzucuoglu (2014) also agrees that identifying and prioritising hazards is crucial after assessing the potential risks they may present. In addition, it has been demonstrated by The International Centre for the Study of the Preservation and Restoration of Cultural Property (2016) that the same concept of risk applies to cultural heritage.

Many things can happen that will have a negative impact on heritage collections, buildings, monuments, sites, and on our objectives regarding their use and conservation. The impact of risk in this case is expressed in terms of the expected loss of value to the heritage asset. For instance, a historic building that catches fire loses a lot of value and its contents. Zakaria and Hua (2024) suggesting that for the purpose of evaluating all elements of authenticity, it is necessary to have knowledge and comprehension of various sources of information in connection to the initial and subsequent qualities of the cultural heritage, as well as their significance. Moreover, Noor et al., (2019) highlights that the true idea of heritage building preservation is to keep its authenticity by following the original or historical data.

One of the horrifying situations that has the potential to cause fatalities and complete building destruction is fire. Fire destroyed many magnificent buildings. Because of large fires, many cities and towns had to rebuild. Aged over fifty and constructed with distinctive period architectural elements, heritage buildings are designated as such. But these structures are extremely dangerous because they are often ill-equipped to handle current fire hazards (Roslan & Said, 2017). However, heritage buildings have significant challenges because the assessment is done at the operational level after the building has been constructed. Nevertheless, many magnificent historic buildings were severely damaged or burned down by fire because of inadequate fire protection and poor level of fire safety management, argues Salleh and Ahmad (2009). In continuation, the same study states that fire is among the main hazards not only to the residents of the building but also to its fabric and items of value.

II. LITERATURE REVIEW

Introduction to Heritage Building in Malaysia

Malaysia boasts a rich legacy that serves to showcase our national identity. The natural beauty of our national parks and the remarkable architecture of our historical structures showcase this heritage (Hakim, 2021). In Graham's (2001) view, heritage is the part of our past that has been kept for the present and will be passed down to next generations. Heritage is defined as the meanings that are ascribed to the past in the present and is knowledge that is defined within a social, political, and cultural context.

Definition

i. Tangible

The National Heritage Act of 2005 defines "tangible cultural heritage" as an area, a monument, and a building.

ii. Intangible

According to the National Heritage Act 2005, anything that can be expressed or found in relation to the heritage of Malaysia, any region of Malaysia, or the heritage of a Malaysian community is considered "intangible cultural heritage." This includes languages, lingual utterances, sayings, musically produced tunes, notes, audible lyrics, songs, folksongs, oral traditions, poetry, music, dances produced through the performing arts, theatrical plays, audible compositions of sounds and music, martial arts, and any other type of expression. Also, The National Heritage Act of 2016 defines intangible cultural heritage as a human act or movement that, while it is done or exists, can be seen, touched, tasted, smelt, or heard, but that, once lost or missing, can no longer be enjoyed.

History of Museum

The term museum has classical roots. In its Greek form, mouseion, it signified the "seat of the Muses" and was referred to as a philosophical institution or a venue for contemplation. Acording to Manssour et al. (2016), Museums are used to preserve history, appreciate artistic icons, and document human science inventions. Museum visitors today come from all over the world, from all ages and cultures, and for various reasons. In the ancient world, museums were primarily institutions of research and learning, rather than places to display artworks and artefacts, despite the fact that they were often located in grand buildings and decorated with examples of fine sculpture and painting. Despite this, museums have been around for a much longer time than one might expect (Cartweight, 2020). Similarly, the International Council of Museums (2022) finds that museum is a not-for-profit, permanent institution in the service of society that researches, collects, conserves, interprets, and shows tangible and intangible heritage. Open to the public, accessible, and inclusive, museums foster diversity and sustainability. They operate and communicate ethically, professionally, and with the participation of communities, offering varied experiences for education, enjoyment, reflection, and knowledge sharing.

Museum in Malaysia

Museums were established in Malaysia even before the nation of Malaysia was formed (Dellios, 1999). The museum industry in Malaysia started in the early 19th century. The Selangor Museum, now known as the original National Museum, was founded in 1907 and managed by the Museum Department of the Federal Malay States as stated by Tham et al. (2020). According to Salleh and Ahmad (2009), many of the museums were constructed prior to independence (1957) or during the colonial period. In 1883, the British government built the Perak Museum in Taiping, which is the beginning of the history of museums in Malaysia, as stated by the Department of Museums Malaysia (2024). This was followed by the Sarawak Museum in Kuching in the year 1888, and then the Selangor Museum in the year 1906, according to the Department of Museums Malaysia. The study Zakaria and Hua (2024) reveals that Malaysia is home to over 350 museums, over 270 registered lifetime private galleries, hundreds of temporary art show sites, and smaller-scale institutions throughout the nation. These institutions result from government and private sector efforts.

Definition of Risk Management

It has been demonstrated by Hassanain M. A.et al. (2022) the most frequent type of fire is a building fire, and most fires occur when facilities are being operated or maintained. Human life, which can only be managed but not eliminated, is closely related to most risk factors that cause fires. Fire risk assessment is a common method for assessing fire safety management and identifying potential risks to address. Several studies in this field have been proposed. In the 1970s, the systematic fire risk assessment method was first used with the risk indexing system in the United States to estimate the potential loss of fire disasters. Fire risk assessment is essential to reduce fire hazards and improve prevention capabilities (Wang, Zheng , & Li, 2024). The Uniform Building By-Law 1984 is used by both departments, i.e. the Building Department and the Fire Services and Rescue Department, to satisfy legislative requirements for building fire safety (Salleh N., Aras A. S. N. , Norazman N. , & Kamaruzzaman S. N. , 2023). According to Papaioannou (1991), determining an acceptable level of safety for both persons and property requires a thorough risk and safety evaluation process. Before designing fire safety, all parties involved (owners, architects, authorities, fire experts, insurance companies, etc.) should talk and exchange thoughts on various elements of the problem.

Combustible Materials and Fire Resources in Heritage Museum Buildings

Fire poses a severe hazard to heritage and historic buildings due to their architectural and cultural significance. However, current standards rarely address the unique characteristics of such buildings with respect to fire hazards. As a result, bringing these buildings into compliance with fire safety regulations while minimizing heritage damage poses significant problems (Garcia-Castillo, Paya-Zaforteza, & Hospitaler, 2023). According to Alba-Rodriguez et al. (2017) and Gaspar et al. (2015) It is vital to highlight that in this scenario, the loss of heritage includes not only the structure and its fabric, but also its contents, such as furniture and pieces of art that cannot be restored. In the context of a museum or gallery collection, the loss of a building's contents and its significance in a fire can be considered a significant loss to the country, as stated by Salleh and Ahmad (2009).

Typically, a fire occurs unexpectedly, leaving building inhabitants with little time to either extinguish the flames or evacuate. Spadaccini (1998) emphasised that uncontrolled fire may lead to the following consequences: a) Fatalities and injuries to individuals unable to evade smoke, gases, and heat; b) Devastation of structures, their contents, and other physical assets; c) Mandatory closure of buildings, either temporarily or permanently, potentially resulting in loss of revenue or bankruptcy; and d) Annihilation of irreplaceable artefacts of human heritage. Museums are the second most prevalent type of fire, following old-shop houses, according to Salleh and Ahmad (2009). However, the museums are primarily chosen due to the fact that the building is a heritage structure with weak fire resistance structures and also houses priceless historical collections, some of which are highly combustible.

Fire Protection System in Heritage Building

In the view of Papaioannou (1991) Historic buildings are still standing structures. Most were constructed earlier than the introduction of Building Codes and Standards. Many people believe that historical buildings continue to remain in their original condition after such a long time without any fire regulations. So, we must "allow people to continue to use them at their own risk". This is not entirely accurate, as traditional builders and engineers have previously used effective fire safety systems on such buildings, saving enough of these historic artifacts. In the words of Akinciturk & Kilic (2004), retaining the historic character of a building while ensuring an acceptable level of safety for its occupants and contents is a challenge in heritage preservation. To preserve the historic character of buildings, architects and engineers must use sensitive and creative techniques for fire prevention and protection. Therefore, because maintaining our legacy is important for current and future generations, it does not have a negative impact on the historic fabric of the building.

According to Salleh (2011) Fire poses a significant risk to heritage buildings, endangering not only the occupants but also the structure and its valuable contents. These structures are irreplaceable and are especially vulnerable to fire for a variety of reasons, including their large size, highly flammable valuable contents, and structural limitations in fire protection. Unfortunately, Malaysia still lacks comprehensive laws and guidelines addressing fire safety in heritage buildings. On the 18 September 2021, Engineer Hao-giang Tay, also stated that most heritage buildings were constructed without the fire safety precautions and fire prevention equipment necessary to guarantee occupant safety prior to the Uniform Building By-Laws' enactment.

Related Legislation and Guidelines on Building Fire Safety in Heritage Building

Malaysia has several legislations that affect the design and management of fire safety in heritage buildings. Legislations can be divided into two categories: fire safety and heritage buildings. Legislations may differ in scope and requirements, but they should be referred to concurrently to ensure satisfactory compliance. Salleh and Ahmad (2009) have noted that, despite the fact that each legislation may have distinct scopes and requirements, in practice,

it is necessary to refer to them concurrently to ensure that all relevant legislation has been followed to a satisfactory level. Therefore, the table 1.0 below shows legislations of Building Fire Safety and Heritage Building.

Table 5.0 Legislation and Guidelines on Building Fire safety in Heritage Building

Building Fire Systems
1) Street, Drainage and Building Act 1974 (Act 133)
2) Uniform Building By-laws 1984 (UBBL 1984)- Peninsular Malaysia & Sabah
3) Building Ordinance - Sarawak
4) Fire Services Act 1988 (Act 341)
5) Occupational Safety and Health Act 1994 (Act 514)
Heritage Building
1) National Heritage Act 2005 (Act 645)
2) Sarawak Cultural Heritage Ordinance (1993)

Fires in Heritage Buildings
The table 2.0 below shows about Fires in Heritage Buildings.

Table 2.0 Fires in Heritage Buildings.

Cause of Fire	***Incident and Description***
Short Circuit Faults in Climate Control Equipment	On September 2, 2018, a fire at the ***National Museum of Brazil*** destroyed over 18.5 million artefacts. The fire was caused by a short circuit in an air conditioning unit. *(Witham, 2019)*
Flammable Gases from Expanding Foam Canister	On November 26, 2014, a fire at the ***Glasgow School of Art*** started when combustible vapours from an inflating foam canister met a heated projector. *(Scottish Fire and Rescue Service, 2014)*
Electrical System Failure	On October 31, 2019, a fire at ***Shuri Castle, Japan***, destroyed several structures covering over 4,000 square meters. Investigators suspect the cause was a malfunction in the electrical system.
Possible Electrical Issues or Smoking During Renovations	On April 15, 2019, a fire broke out at ***Notre-Dame Cathedral*, Paris**. The cause remains undetermined, but theories include smoking by workers, or a short circuit related to the electric bells.
Malfunctioning Lighting	On November 20, 1992, a fire at ***Windsor Castle, UK***, destroyed 115 rooms, including nine State Rooms. It was caused by a malfunctioning light that ignited a curtain near the altar.
Defective Electrical Distribution Board	On April 29, 2015, a fire at ***Clandon Park, UK***, was ignited by a malfunction in an electrical distribution board in a basement cabinet. The fire destroyed one of the finest Palladian buildings in the UK.

Fire Protection Technology in Heritage Building
There are various studies that discuss ways to increase fire safety in historical buildings using modern fire prevention methods. According to Doulgerakis et al. (2021) some writers recommend using technology methods to handle fire crises in ancient structures. He also states that developed a platform for cultural heritage sites which encompasses processes for semi-automatic digitalization of built heritage, simulation software for research into potential fire scenarios and crowd behavior, real-time fire detection and monitoring systems, and a fire emergency management decision support system. Guan et al. (2018) proposed the use of wireless networks in historic buildings to give live feedback on fire detection, smoke conditions, and fire-safe routes, which are safe ways out of a fire. The networks can also be used to improve fire safety management in historic buildings.

According to Furmanek (2025), if a historic building has a control system installed, alternative fire safety measures such as closures can be used. These measures tend to be based on devices that prevent explosions, trigger early fire warnings and reduce their impact while ensuring that the cultural and architectural identity of the building is not severely affected. Some of this equipment include emergency lighting (emergency and safety evacuation lighting), permanent and semi-permanent fire extinguishers, water hydrants, water installations, safety equipment, water tanks, and fire pump stations, among others, passive fire protection, and replacement solutions.

Fire has unimaginable costs for structures that are part of cultural heritage. The use of the ZIgBee fire network system has emerged as an innovative fire safety management technique aimed at raising the standard of fire safety management and fire protection of cultural heritage buildings in our nation (Guan et al., 2018). In addition, Guan et al. (2018) also elaborated that at present, the deployment of ZigBee technology in cultural relic construction is primarily limited to wireless ZigBee monitoring of fire hydrants, ZigBee iot alarm system, thermal imaging alarm monitoring, mobile terminal information sharing system, radio frequency localization technology, ZigBee iot terminal, etc.

III. METHODOLOGY

The research opted to use qualitative methods to achieve the research objectives. There are four methods used to achieve research objectives, which are Desktop study, Observation, Building Audit, and Comparison analysis using Uniform Building By-Laws (UBBL) 1984.

Case Studies

The purpose of the case study is to evaluate fire risk assessment in heritage museum buildings based on the List of National Heritage Buildings under the National Heritage Act, 2005, whether the building is complying or not with the Uniform Building By-Laws (UBBL) 1984. The case study has been chosen based on its historical significance, unique architecture, and the necessity of protecting it from fire hazards. The selected location for this case study is at Kuala Lumpur, chosen to meet the aims of this research. Furthermore, the case study will conduct walkthroughs to observe the fire safety implementation in the three (3) selected heritage museum structures, which are referred to as Building A, Building B, and Building C, and are accessible to the public (refer to Table 3.0).

Table 3.0 Heritage Museum Buildings Background Information

Building	*Years of Built*	*Years of Gazetted*	*Function*
A	1905	1983	A museum that exhibits the local textiles and their significance in Malaysia's heritage.
B	1963	2015	An educational, national identity, and public awareness museum that exhibits Malaysia's historical and cultural heritage for the purpose of preservation, research, and display.
C	1988	2009	It is responsible for showcasing a variety of royal collections and preserving and promoting the rich history, heritage, and role of the royal institution in the nation.

Comparison Analysis using Unifrom Building By-Laws (UBBL) 1984

Three heritage museum buildings have been selected for the case study, where research will be conducted. The fire risk assessment checklist for historic museums is based on the related Uniform Building By-Laws 1984 (UBBL), since it does not serve as a checklist. The UBBL is an act of legislation that brings together Malaysia's building laws. It includes rules for safety, planning, and construction. This information will be turned into a list that can be used to check if fire risk ratings follow the rules stated in UBBL 1984 for fire safety.

The checklist will be used in assessing the compliance of historical museum buildings with the UBBL 1984 requirements. It is used to ensure that the work is carefully and systematically assessed to include key elements such as fire safety, structural stability and access while ensuring the integrity of the original requirements. Additionally, the only sections addressed in the Uniform Building By-Laws (UBBL) 1984 are PART VII, referring to Fire Safety Installation Requirements, and PART VIII, concerning Fire Alarm Systems and Fire Extinguishing Systems. The remaining part will be ignored since it is unrelated to the case study.

The Uniform Building By-Laws (UBBL) 1984 provides guidelines for examining the building for comparison. This is carried out by utilising Part VII (Fire Safety Installation Requirements) and Part VIII (Fire Alarm System and Fire Extinguishment System), the table below, for instance, shows the by-laws that will be used to help with this purpose of study.

PART VII
FIRE SAFETY INSTALLATION REQUIREMENTS

By-Laws	Description	By-Laws	Description
137	Compartmentation by height.	177	Computing number of staircases and staircases widths.
138	Other walls and floors to be constructed as compartment walls or compartment floors.	178	Exits for institutional and other places of assembly.
138A	Partition.	179	Classification of places of assembly.
140	Fire appliances access.	180	Space standards for calculating occupancy loads.
141	Separating walls.	181	Width of means of escape.
142	External walls.	182	Rate of discharge.
143	Beam or column.	183	Exit details for places of assembly.
144	Cladding on external wall.	186	Exit doors in places of assembly.
145	Reference to Sixth Schedule.	187	Notice affixed to door of gate.
147	Construction of separating wall.	188	Travel distance in place of assembly.
148	Special requirements as to compartment walls and compartment floors.	189	Enclosing means of escape in certain buildings. External exit staircase.
149	Horizontal and vertical barriers at the external walls.	190	Staircases to reach roof level.
150	Protected Shaft.	195	Smoke lobbies.
156	Protected shafts as ventilating duct.	196	Protected lobbies.
157	Protected shafts consisting of staircase.	197	Fire fighting access lobbies.
158	Stages in places of assembly.	197B	Ventilation of staircase enclosures.
159	Open stages.	198	Ventilation of staircase enclosures in buildings
160	Fire precaution in air-conditioning systems.	199	not exceeding 18 metres.
161	Fire stopping.		Ventilation of staircase enclosures in buildings
162	Fire doors in compartment walls and separating walls.	200	exceeding 18 metres. Staircase enclosure below ground level.
163	Half hour and one-hour doors.	201	Pressurized system for staircases.
165	Measurement of travel distance to exits.	202	Restriction of spread of flame.
166	Exits to be accessible at all times.	203	Classification of restriction of flame over
168	Staircases.	204	surfaces of walls and ceilings. Classification of interior finish materials.
169	Exit route.	205	Classification of surface of wall or ceiling.
170	Egress through unenclosed openings.	206	Reference to roofs.
171	Horizontal exits.	208	Construction of roofs.
172	Emergency exit signs.	210	Materials for construction.
173	Exit doors.	211A	Category designation for fire penetration and
174	Arrangement of storey exits.	212	spread of flame on roof surfaces. Fire resistance.
174A	Final exit.	213	Floor area and capacity of buildings and
175	Calculation of occupant load.	220	compartments. Test of fire resistance.
176	Computing storeys exit widths.	221	Fire resistance for walls.
214	Additional requirements.	222	Fire resistance for floors above ground floor.
215	Height of buildings.	223	Fire resistance for any element of structure.
217	Fire resistance of structural member.	224	
218	Compartment wall separating flats and maisonette.		
219	Application of these By-Laws to floors.		

PART VIII
FIRE ALARM SYSTEM AND FIRE EXTINGUISHMENT SYSTEM

By-Laws	Description
225	Fire alarm system and extinguishment system.
226	Automatic system for hazardous occupancy.
226A	Hose reel systems.
227	Portable fire extinguisher.
228	Sprinkler systems.
228A	Automatic fire monitoring system.
230	Dry riser systems.
231	Wet riser systems.
235	Fixed extinguishing systems.
236	Special hazards.
237	Fire alarms systems.
238	Fire command centre.
239	Voice communication system
240	Electrical isolation switch
241	Special requirements for fire alarms systems.
243A	Emergency mode of operation in the event of mains power failure.
243B	Fire mode of operation.
245	Approval of director general.
248	Marking on wet riser, etc.
249	Smoke control.
252A	Atrium in buildings.
253	Emergency power system.
253A	Emergency lighting.

IV. DISCUSSIONS

In this study, the discussion presents a predicted evaluation of fire risk assessment in heritage museum buildings based on desktop study and analysis of the Uniform Building By-Laws (UBBL) 1984. As a result, three (3) heritage museum buildings have been chosen for the purpose of this study. First, we review the heritage museum building and identify their function. These are the steps where study for building observation and building audit started on to collect the primary data by observing and assessing the structural design and safety features, overall condition in each building. Besides that, The Uniform Building By-Laws (UBBL) 1984 will be a very useful guide during the site visits to the historical institutions. This document, which outlines minimum building regulations and safety standards, will be reorganized into a checklist format to allow for detailed evaluations without changing its original content or purpose. In addition, it is used to ensure that the work is carefully and systematically assessed to include key elements such as fire safety, structural stability and access while ensuring the integrity of the original requirements. Hence, the only sections addressed in the Uniform Building By-Laws (UBBL) 1984 are PART VII, referring to Fire Safety Installation Requirements, and PART VIII, concerning Fire Alarm Systems and Fire Extinguishing Systems.

Expected Compliance with The Uniform Building By-Laws (UBBL) 1984
The table 4.0 below shows about expected compliance with The Uniform Building By-Laws (UBBL) 1984 on three (3) heritage buildings that have been selected for the study.

Table 4.0 Expected compliance with The Uniform Building By-Laws (UBBL)

By-Laws	***UBBL 1984 Requirement***	***Expected Compliance***	***Potential Issues***
227	Fire Extinguisher	Likely Compliant	Museums might not have enough units of fire extinguisher.
166,172, 253A	Exit Signage	Likely Compliant	Signs may not visible or properly positioned for visitors to see in an emergency condition.
225	Smoke Detectors	Partially Compliant	Older building might have outdated detectors that are not connected to a modern fire monitoring system.
141, 142, 143,	Fire Compartmentation	Not Compliant	Because of their historical construction methods, most heritage buildings lack fire-rated compartment walls.

144, 222, 224			
228A	Automatic Sprinklers	Partially Compliant	Older building might have outdated detectors that are not connected to a modern fire monitoring system.
165	Fire Escape Routes	Partially Compliant	Many heritage buildings have limited emergency exits or narrow staircases, making evacuation difficult.
162, 164	Fire Doors	Not Compliant	Most heritage museums have wooden doors, which are not fire-rated door.

Challenges in Maintaining Heritage Buildings

Based on the previous studies, current lingering issues in heritage buildings include most heritage building administration in Malaysia still lacks knowledge and awareness about proper fire safety management for heritage buildings. The behaviours of the inhabitants, a lack of understanding, and inadequate management of the safety of the workspace all contribute to an increase in the fire hazards (Hassaian M. A. , Al-Harogi M. , & Ibrahim A. M. , 2022). Findings by Salleh and Ahmad (2009) indicate that fire safety management in Malaysia's heritage buildings is assessed through a series of interviews and observational surveys. Thirty-seven heritage structures have been assessed as part of their study sample. The study revealed that the majority of the buildings continue to exhibit inadequate fire safety management. According to the same research, many heritage buildings in Malaysia need a more cautious approach than new builds owing to their architectural and historical value. A high level of fire safety management is required for several architectural styles, including traditional Malay, Portuguese, Dutch, and British influences like Moorish architecture. In addition, all of the research also showed how staff members and residents of the chosen case study were not adequately trained in fire safety, which could result in their failure to use fire extinguishers or flee during a fire (Mydin, Sani, Abas, & Khaw, 2014).

Based on the study of related problems, other issues that lingered in heritage building industry is Heritage buildings erected before the Uniform Building By-law 1984 are exempt from fire safety requirements outlined in bylaws. For instance, a fire can quickly destroy a structure and its contents, resulting in a loss of authenticity. It is the most major hazard to cultural heritage (Kidd, 2003). As a result, fire has destroyed many historic buildings, such as Windsor Castle in England in 1992 (Utt, 2013) and the National Museum of Brazil in Rio de Jeneiro in 2018 (BBC, 2018). Unfortunately, as mentioned by Salleh and Ahmad (2009), there are relatively no adequate legislations or rules on fire safety for heritage buildings in Malaysia. This remains the case even to this day. In fact, the Fire and Rescue Department of Malaysia (FRDM) emphasised that the protection of human life is the most important element of fire safety in architectural structures.

Many heritage buildings lack adequate fire protection measures that are both effective and appropriate for the building's historical design. This deficiency increases the risk of fire damage to the structure and its valuable contents. Indeed, installing high-end protection measures in a building is pointless if fire safety management is poor, for example, irregular maintenance, lack of training, poor housekeeping, etc (Salleh & Ahmad, 2009).

CONCLUSION

In conclusion, the assessment of the passive and active fire protection systems integrated within heritage buildings in Part VII and Part VIII are of utmost importance for safeguarding these unique cultural treasures. Heritage buildings have special fire protection needs because of their unusual fires and protective features and outdated materials and construction methods. Constantly upgrading the passive fire protection measures as well as active fire protection systems would mitigate the risk of fire damage or destruction. In addition, safeguarding fire safety within these buildings from heritage sites is very important from the tourism perspective. Heritage sites attract millions of visitors each year making fire safety vital in protecting people and economic sustainability of the tourism industry. Well defined strategies for fire prevention improve visitor safety while protecting the historical landmarks. Finally, this research is of great importance stemming from compliance with law and regulations. Historically, these places are required to follow strict building regulations and preservation laws to ensure their legal status and eligibility for government funding or support.

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