FIRE SAFETY MANAGEMENT IN HERITAGE BUILDINGS: THE CURRENT SCENARIO IN MALAYSIA

N.H. Salleh [a] and A.G. Ahmad [b]

[a] Dept. of Architecture, K.A.E.D., International Islamic University Malaysia, Kuala Lumpur - hamiruddin@gmail.com
[b] School of Housing, Building & Planning, Universiti Sains Malaysia, Penang- aghafar@usm.my

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ABSTRACT:

In Malaysia, there are many heritage buildings with an architectural and historical significance that influenced by several architecture styles including a traditional Malay architecture, the Portuguese architecture, the Dutch architecture, and the architecture styles brought by British (e.g. Moorish, Tudor, Neo-Classical and Neo-Gothic). Most of them are worthy to be listed as Heritage Buildings or National Heritage Buildings under the National Heritage Act 2005 (Act 645). The Malaysian government is undertaking many efforts to promote conservation and preservation of heritage buildings in the country. Some of the buildings have been changed to different functions from its original (adaptive-reuse) such as into museums, libraries, offices or hotels. It is however, in the past few years there are few priceless heritage buildings were badly damaged or burnt down by fire includes the People Museum, Melaka (2001), Rumah Pak Ali , Gombak (2003) and Sarawak Club, Kuching (2006). In one case, it was given a total loss approximately up to MYR 5 millions. Fire is one of the greatest threats to heritage buildings not only to the building's occupants but also to the building's fabric and contents. Heritage buildings are irreplaceable but vulnerable to fire as there is a combination of several factors: large scale buildings; flammable priceless contents; large numbers of visitors; and existing structures weak on fire resistance. Unfortunately, until today, there are relatively no sufficient legislations or guidelines on fire safety for heritage buildings in Malaysia. In fact, the Fire and Rescue Department of Malaysia (FRDM) stressed the safety of life is the ultimate principle of fire safety in a building. Property protection which includes protection to building's fabrics and contents of heritage buildings is not really been prioritised. The purpose of this research is to investigate the current fire safety management in heritage buildings in Malaysia through a series of interview and observation surveys. In this research, thirty seven heritage buildings have been surveyed as a building sampling. The finding found that most of the buildings are still having a poor fire safety management. From the survey, seventeen leading fire safety management problems in the buildings have been identified.

1. MANUSCRIPT

1.1 Introduction

In Malaysia, there are many heritage buildings with architectural and historical significance that influenced by several architecture styles including a traditional Malay architecture, the Portuguese architecture, the Dutch architecture, and the architecture styles brought by British (e.g. Moorish, Tudor, Neo-Classical and Neo-Gothic). Most of them are worthy to be listed or gazetted as a Heritage Building or National Heritage Building under the National Heritage Act 2005 (Act 645). In order to preserve the buildings, most of them have been changing to different functions from its original (adaptive-reuse) such as museums, libraries, offices and hotels. Recently, continuous efforts in the conservation of built heritage in Malaysia have received an international recognition where on 7 July 2008 Melaka and Georgetown of Penang have been listed as a World Heritage Site known as 'Historic Cities of the Straits of Malacca' from the United Nations Educational, Scientific and Cultural Organisations (UNESCO). Nevertheless, due to poor standard of fire safety management and inadequate fire protection, many priceless historic buildings were badly damaged or burnt down by fire. In fact, fire damaging heritage building is also an international crisis; for example in the UK a rate of more than one heritage buildings of national and international importance have been seriously damaged by fire per year (Kidd,1995, p.12).

In term of fire safety approach, practically, a heritage building requires relatively more sensitive approach compare to a new building; a high standard of fire safety management is required for heritage buildings, not only to protect people but as well as to protect historical contents, fabrics and structures of the building. Heritage buildings are irreplaceable but vulnerable to fire as there is a combination of several factors: large scale buildings; flammable priceless contents; large numbers of visitors; and existing structures weak on fire resistance.

1.2 Fire and Heritage Buildings

It is widely accepted that fire is one of the greatest threats not only to the building's occupants but also to the building's fabric and contents. Fire has long been an enemy of heritage structures, with some older structures falling victim many times. One example is the LaFenice Theatre (Venice Opera House) that first opened in 1792 on the site of a theater that burned down in 1773 was again extensively damaged by fire in 1836 and 1996 (Bukowski, Nuzzolese and Bindo, 2001). The Windsor Castle (UK) also was badly damaged by fire in 1992 (Table 1); it was probably caused by curtain being ignited by a wall-mounted

spotlight which was too close behind it and resulted total loss at least USD 90 million.

No	Buildings Name	Date of Fire Incidents
1	York Minster, England	July 1984
2	Hampton Court Palace, England	March 1986
3	Uppark House, England	Aug. 1989
4	Proveantgarden, Copenhagen, Denmark	Feb.1992
5	Odd Fellow Palace, Copenhagen, Denmark	April 1992
6	Christianborg Palace Church,Copenhagen, Denmark	June 1992
7	Windsor Castle, England	Nov. 1992
8	Redoutensal, Hofburg Palace, Vienna, Austria	Nov.1992
9	Pont de la Chapelle, Lucerne, Switzerland	Aug. 1993
10	Namdaemun Gate, Seoul, South Korea	Feb. 2008
11	Castello di Moncalieri, Turin, Italy	April 2008

Table 1: A series of major heritage buildings fire in the world from 1984 to 2008.

In fact, history shows that fire was recognised as a threat to great civilizations as early as 2000 years ago. The Roman Empire devised a system of corps vigilante whose sole task was to be on watch for the outbreak of fire. The Great Fire of London in 1666 became the catalyst for the modern day building codes. The fire broke out in a baker's shop and destroyed half of London. The buildings in London at that time were not fire separated and so the fire spread easily. Analysis of how the fire spread led to the creation of the first building regulations (Spadaccini, 1998).

1.3 Fire Protection for Heritage Buildings

In protecting and preserving the historic fabric of the heritage structure, Escape Consult (2006) stressed that there are some major differences which is a challenge for the architect and fire protection engineer in the application of general fire protection principles. The challenge in protecting heritage structure is to maintain their historical fabric while providing a reasonable level of safety for their occupants and contents. In order to avoid harming the building's historic character, the architect and engineer will need to have the sensitivity and ingenuity approaches to provide fire prevention and protection measures that do not damage the historic fabric of the building.

In other words, in upgrading any heritage buildings the architects, engineers or conservators should with a concept of balancing fire engineering with conservation aims in their mind. Standard fire protection approaches that normally ideal for new constructions may have adverse impacts on heritage materials and spaces and destroy the very qualities that give a space its historic character (Watt Jr. and Solomon, 2002, p. 302). Practically, factors to be considered in determining acceptable levels of fire protection in heritage buildings are:

a) the age of the structure and its type of construction, its uniqueness;
b) site location and accessibility;
c) occupancy and use;
d) means of egress and distances of travel to exits;
e) size and height of the structure;
f) qualities of finishes; and
g) types of building contents.

In this regard, Kidd (2001, 2005) suggested that all fire protection improvements for heritage buildings should follow the following principles:

- **Minimal Intervention:** Any changes to a listed or heritage building must cause as little impact on the building and its fabric as possible. Any work undertaken to improve compartmentation, or to provide fire detection or suppression, should not cause unnecessary disruption or damage during installation, maintenance or eventual removal.

- **Reversibility:** Any changes to a heritage or listed building should wherever possible be reversible, i.e. adopting a 'plug in, plug out philosophy'.

- **Essential:** Only the minimum amount of work necessary to achieve the stated objective(s) should be undertaken and all the work should be justified and informed by a detailed fire risk assessment.

- **Sensitive:** Fire protection devices, equipment and systems should be installed with due consideration to the overall appearance of the building as well as having the minimum impact on the fabric of the building which they are intended to protect.

- **Appropriate:** The fire protection measures adopted must be appropriate to the level of risk- for example there may be little point in providing a full automatic sprinkler system for a location which is sparsely furnished and where there is little or no fuel load.

- **Legal Compliance:** The fact that certain fire protection measures are required by law does not overrule the need to comply with other legal requirements (listed building consent, planning permission, building standards, fire regulations and certification procedures).

2. FIRE SAFETY MANAGEMENT FOR HERITAGE BUILDINGS

Howard and Kara-Zaitri (1999,p.364) has described that fire safety management can be defined as "the application by a manager of policy, standards, tools, information and practices to the task of analysing, evaluating and controlling fire safety". A view supported by Pickard (1994, p.8) who stated that "a fire safety strategy for a specific building needs management policies and procedures to ensure the effective operation of the strategy" and it should be on an ongoing basis where fire safety systems need to be regularly checked and maintained.

Normally, fire takes place without warning and may cause building occupants have limited time to react either to distinguish the fire or to escape. Spadaccini (1998) highlighted that when fire is not controlled the following may result:

a) Death and injury of people who cannot escape its smoke, gases and heat;
b) Destruction of buildings, their contents and other tangible property;
c) Building have to close either temporary or permanent which could cause loss of income or possibly bankruptcy; and
d) Destruction of irreplaceable reminders of human heritage.

Therefore, the most effective method to eliminate the risks of fire is to conduct a fire risk assessment regularly with close

monitoring and reviewing; i.e. 'prevention is better than cure'. Indeed, a heritage building owner / manager should play an important role in safeguarding their building and must possess a good fire safety management. An efficient fire safety management is essential because the majority of heritage buildings, whether aware or not, are exposing to fire risks due to the following factors:

a) existing structures weak on fire resistance; aging or decaying building materials and combustible materials e.g. timber;
b) inadequate fire prevention and protection systems, notably passive fire protection;
c) poor fire safety awareness among the building owners, managers, staff and public;
d) low standard of management, housekeeping and maintenance;
e) few heritage buildings located at busiest area or narrow road where without a good access for fire brigade;
f) existing electrical wiring not been upgraded or replaced accordingly; few heritage buildings are still using old electrical wiring that may cause faulty electrical.
g) storage for many flammable artefacts or heritage collections such as old books, manuscripts, traditional costumes and antique furniture;
h) large number of visitors; most open daily to public;
i) the danger from renovation works;
j) possible danger from nature factors such as lightning, overheating etc.; and
k) the danger of careless and arson.

In this regard, Opus Consulting (2004, p.3) recommended that the 'best-practice' management procedures are the steps that are taken when planning the management of fire risk. They are based on the four following criteria: prevention, preparation, response and recovery. Nevertheless, fire safety in a heritage building is the joint responsibility of building owners, occupants (staff and visitors) and related authorities because an authentic heritage fabric and content lost to fire is irreplaceable; no matter how good subsequent restoration may be, the original has been lost forever. All concerned must be aware of their individual duties in ensuring that adequate standards of fire safety and property protection are both provided and maintained.

3. HERITAGE BUILDINGS FIRE IN MALAYSIA

3.1 Fire in Malaysia

The Fire and Rescue Department of Malaysia (FRDM) reported that from 2005 to 2007 fire was caused total loss of more than MYR 2.4 billion that claimed 221 lives and injured 268 people (Table 2); the highest total death and total lost is recorded in year 2007. Furthermore, 3,447 (17%) from the total of 20,225 fire cases in 2007 were involved building fires, in fact it was gradually increased from 2000 to 2007 (Figure 1).

Year	Fire call	Affect of Fire		Estimated loss (MYR)
		Death	Injured	
2005	31,138	70	115	794 Mil.
2006	18,913	71	86	760 Mil.
2007	20,225	80	67	865 Mil.
TOTAL	**70,276**	**221**	**268**	**2.4 Bil.**

Table 2: Fire statistic in Malaysia for 2005 -2007
(Source: Fire and Rescue Department of Malaysia)

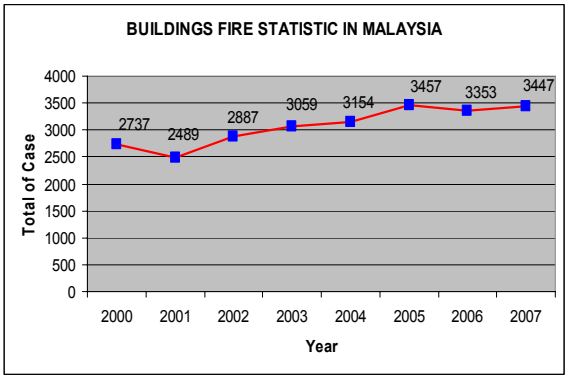

Figure 1: Buildings fire statistic in Malaysia from 2000-2007.
(Source: Fire and Rescue Department of Malaysia)

3.2 Heritage Buildings Fires in Malaysia

In the context of heritage buildings, until today, fire was damaged and destroyed many heritage buildings in Malaysia which given total loss approximately up to MYR 5 millions (Table 3). It is believed that the main reason of the problem is due to fire safety awareness among the public is still very low.

Date	Building	Estimated Loss (MYR)
17 Sept. 1992	National Museum Malaysia (1959), Kuala Lumpur	100,000
Mac & Dec. 1992	High Court Building (1896), Kuala Lumpur	
12 Sept. 1996	Sultan Abu Bakar Royal Museum (1864/66), Johor	Undisclosed
15 Mac. 1997	Sultan Abu Bakar Royal Museum (1864/66), Johor	Undisclosed
02 Dec. 2001	The People's Museum, Melaka	
20 Oct. 2003	Rumah Pak Ali (1876), Gombak, Kuala Lumpur	> 1 mil.
27 June 2005	23 Shop-houses pre-World War, Meru, Klang, Selangor	5 mil.
27 June 2005	13 Shop-houses pre-World War, Kampung Sentosa, Kuala Lumpur	> 500,000
17 July 2006	Shop house (>1806), Jalan Laksamana, Bandar Hilir, Melaka	
27 July 2006	Sarawak Club (1876), Kuching	
24 July 2007	Ipoh Police Volunteer Mess Hall (1910), Ipoh, Perak	
30 Sept. 2007	PULAPOL Senior Police Quarters (1940), Jalan Semarak, Kuala Lumpur	300,000
19 Mac. 2008	6 units of Old Shop-houses (1895), Taiping, Perak	> 300,000
05 May 2008	38 units of Punan Bah longhouse, Belaga, Sarawak	> 500,000
11 July 2008	Memorial Datuk Onn Jaafar, Batu Pahat.	Destroyed 70% of the building and artefacts
11 Dec. 2008	7 Old shop houses, Lebuh Armenian, Penang (In World Heritage Site zone)	± 600,000

Table 3: Fire statistic for heritage buildings in Malaysia from 1992 – 2008

3.3 Legislation and Guides on Building Fire Safety and Heritage Building

There are seven main legislations in Malaysia that may directly and indirectly relates to design and manage fire safety for heritage buildings in Malaysia. Those legislations may divide into two key aspects: building fire safety and heritage building (Table 4). Even though, each legislation may consists different scopes and requirements; however, in practice, they must be concurrently referred in order to ensure all the related legislations have been complied at satisfactory level.

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

Table 4: List of legislations related to building fire safety and heritage building in Malaysia

At state level, all local authorities in Malaysia historic city (e.g. Kuala Lumpur, Georgetown, Malacca and Taiping) have formulated an individual conservation guideline for their own historical areas. Most heritage buildings are statutorily listed under the conservation legislation and any alterations, external or internal, affecting their character as buildings of special interest must be the subject of an application for Listed Building Consent to the local planning authority. Nevertheless, in the context of fire safety, none of the state conservation guidelines provides a comprehensive guide to architects, conservators and managers. This is believed due to poor awareness on fire safety among the local authorities and therefore, gives less priority to the fire safety needs. Alternatively, few international codes and guides that published by a non-profit organisation such as National Fire Protection Association (NFPA), Historic Scotland and Fire Protection Association which are useful for reference (Nurul Hamiruddin and A.Ghafar, 2007, p.423).

4. FIRE SAFETY MANAGEMENT IN HERITAGE BUILDINGS IN MALAYSIA

4.1 Case Study

The research mainly focused on heritage buildings that has been used as museums as a sampling building of Malaysian heritage buildings. Even though, from fire statistics that involved heritage buildings in Malaysia (Table 3), museum fires are the second leading case after old-shop houses. Nevertheless, the museums are selected mainly because the building is not only a heritage building that mostly with weak fire resistance structures but also containing priceless historical collections (some of them are highly combustible). Obviously in the context of a museum or gallery collection, the loss of a building's contents and its building's significance in fire can be consider as a great lost to the country. This is what happened to Rumah Pak Ali of Kuala Lumpur in 2003 fire tragedy (Figure 2) where the building and its contents were totally destroyed and total lost approximately more than RM 1 million; the building before the tragedy was one of main attraction place to local and international tourists in Kuala Lumpur.

Figure 2: The wooden building of Rumah Pak Ali that built on 1876 was destroyed by fire on 20 Oct. 2003.

From the survey, 55 museums (42%) from the total of 132 museums in Malaysia are currently using buildings that were age 50-year or more and could be called as heritage buildings (Figure 3). Most of them were built during the colonial period or before the independence (1957). In fact, some of them with age more than 100-year old such as the History and Ethnography Museums (Stadhuys) of Melaka, Perak Museum, Sarawak State Museum, Penang Islamic Museum and Kelantan Royal Customs Museum. At beginning, the researcher tried to visit as many museums as possible but due to many reasons such as time constraint, some museums temporary closed for upgrading, and not permitted to conduct the research. As a result, in this research, 37 museums in nine different states were finally surveyed. The aim of this observation survey is to investigate the practice of fire safety management in the buildings by the respective administrators. This survey also provides direct observation on the existing fire safety prevention and protection measures in the buildings. Statistically, the surveyed museums represents 57% sampling of 56 total museums that using heritage buildings, thus the number is good enough to provide the relevant information for the research.

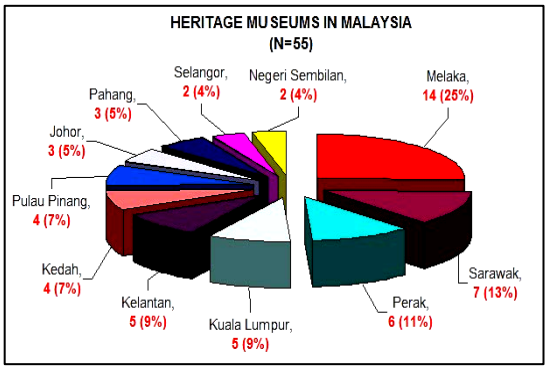

Figure 3 : Tabulation of heritage museums in Malaysia. (Source: Survey 2008)

4.2 Selection of Heritage Buildings

The purpose of this research is to investigate the current fire safety management in heritage buildings in Malaysia through a series of interview and observation surveys. Therefore, there are thirty seven (37) heritage museums have been selected; in

which four museums were belong to the Federal Government under Department of Museum Malaysia. Meanwhile, twenty-two museums under the administration of State Governments, nine museums under the administration of Government Agencies, one museum each under the Government Link Company and private agency. The selection of the surveyed museums was based on the following factors:

a) building physical (age, size and building materials)
b) building collections
c) administrative agency

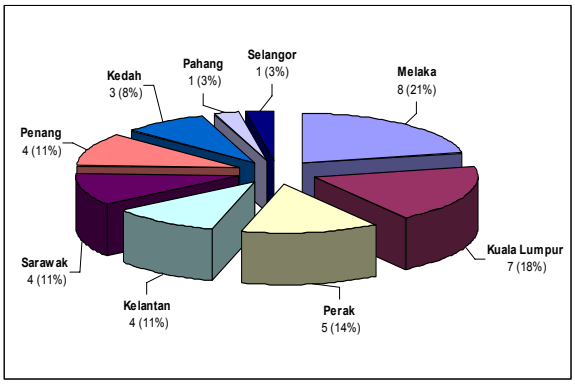

Figure 4 : Location of the surveyed museums by states.

4.3 Survey Findings

Figure 4 shows the location of surveyed museums, in which 21% museums are located in Melaka and followed by Kuala Lumpur with 18% museums. The survey was begun from June 2007 and end on August 2008. As the result, the survey found that most of the museums are still having poor fire safety management. Seventeen main weaknesses on fire safety management encountered in the museums are as follows:

a) Building without fire safety plan (100%)
b) Building without Fire Certificate (97%)
c) Building not disabled friendly (97%)
d) Building without fire safety policy (95%)
e) Not conduct regular risk assessment (89%)
f) Building without direct link system to the nearest Fire Station (86%)
g) Not conduct fire drill (84%)
h) Building without emergency / back-up power supply
i) Insufficient safety signages (70%)
j) Building without insurance coverage (68%)
k) Building without hose reel system (59%)
l) Building without close-circuit television (54%)
m) Building without public-address system (51%)
n) Building without emergency alarm (46%)
o) Building without automatic detectors (43%)
p) Locked / obstructed fire exit (43%)
q) Building without 'EXIT/ KELUAR' sign (30%)

5. RECOMMENDATIONS TO IMPROVE FIRE SAFETY MANAGEMENT

As mentioned earlier, in order to ensure the high standard of fire safety in heritage buildings three main parties should be closely cooperated, namely the building owners or administrators, building occupants/users and authority bodies. Therefore, it is essential that all of them must have a good awareness on fire safety. They should play their roles accordingly to safeguarding the safety of occupants, historic fabrics and contents in heritage buildings. Some of pro-active actions could to be taken are summarised as follows:

5.1 The Building Owners/Administrators:

a) Consult regularly with local fire brigades on risk management, fire fighting and salvage;
b) Where legally required, fire certificates should be obtained and their requirements fully complied with;
c) Formulate a written fire safety policy statement that to be informed or distributed to all staff. Effective internal mechanisms should exist to ensure that the policy is properly implemented and annually reviewed;
d) Appoint a fire safety manager with specific responsibility to implement the fire safety policy;
e) Form a central fire safety committee, meeting at least once a year to review fire risk management and ensure that the fire safety policy statement is implemented;
f) Ensure that all signage on fire safety and procedures are sufficient and should be properly displayed and located;
g) Inspect that no obstacle at all times to fire exits, hose reel, evacuation routes, etc;
h) All fire prevention and protection measures should be inspected and maintained periodically; to ensure all systems are in working order;
i) Provide a comprehensive fire action plan. Exercises should be arranged periodically;
j) Appoint a reliable consultant to carry out a detail fire risk assessment annually;
k) Identify important risks and danger of fire spread, and eliminate unnecessary hazards;
l) Fire drills should be organised at least six-monthly intervals under the supervision of the local fire brigade;
m) All staff should undergo a basic fire safety training annually, to ensure all staff knows how to minimise fire risks and how to react in the event of a fire;
n) The installation of a reliable fire detection and protection system should be seen as a high priority;
o) Purchase an insurance policy for building and contents (if classified as a high heritage value). Traditionally, insurers conduct regular inspections of their insureds' properties to assure that risk management practices and procedures are being implemented;
p) Each heritage building that containing many historical contents (e.g. museum) should have a trained salvage team, with regular exercises in co-operation with the local fire brigade; and detailed plans for the salvage of contents;
q) Clear fire safety requirements should be included in all contracts for building, maintenance, renovation and for special events. Management must check to ensure that the requirements are being carried out; and
r) A proper programme of preparation and safe storage (possibly off-site) of architectural, photographic and other information should be put in place.

5.2 The Building Occupants / Users:

a) Comply all requirements in the fire safety policy that formulated by the building administrator;
b) Cooperate with the building administrator to ensure the building and contents are safe at all times;
c) Continuously enhance personal awareness and knowledge on fire safety;
d) Not smoking in the building;
e) Immediately inform the building administrator if encounter any sign of fire risks;

f) Fully participate in fire training and drills that organised by the administrator; and
g) Report to the related authority if spot the building is not complying any legal fire safety requirements.

5.3 The Authority Bodies (Government, Fire Brigade):

a) Ensure all heritage buildings are complying the current fire safety requirements;
b) Carry out an effective and efficient enforcement; spot-check to be conducted regularly;
c) Formulate a comprehensive fire safety guidelines specifically for heritage buildings;
d) Make compulsory to all heritage buildings to install a reliable fire detection and protection systems;
e) Requires every heritage building to have a Fire Safety Manager with proper training and complete authority to control all decisions related to fire safety;
f) Regularly conduct fire safety campaigns to increase awareness among the public; and
g) If necessary, review or/and amend legislations or acts that related to building fire safety and heritage buildings (e.g. increase penalty).

6. CONCLUSIONS

It is widely accepted that a heritage building is exposed to more fire threats unlike in a new building. In case of fire, indeed protecting life safety remains as the main priority; however, appropriate steps should be taken to prevent fire damaging the priceless heritage buildings and its contents. If necessary to upgrade fire safety in a heritage building, the fire protection measures must be designed with a sympathetic approach to heritage fabrics of the building. Indeed, the installation of high-end protection measures in the building will be meaningless if with a poor fire safety management (e.g. irregular maintenance, no training, poor housekeeping etc.). Even though, the research discovered that most of the surveyed heritage buildings are still with poor fire safety management and unreliable fire safety measures. Nevertheless, it is not too late for the relevant agencies to take pro-active actions in order to prevent and protect heritage buildings and its contents from fire. Finally, "prevention is better than cure" or "why waits for bad things to happen when we can do something to prevent them from occurring?"

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