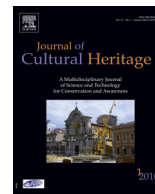




Available online at
ScienceDirect
www.sciencedirect.com

Elsevier Masson France
EM|consulte
www.em-consulte.com/en



Cultural HELP 2014 Special Issue

More effectively addressing fire/disaster challenges to protect our cultural heritage



Christopher E. Marrion*

Marrion Fire & Risk Consulting PE, LLC, New York, NY, USA

ARTICLE INFO

Article history:

Received 17 January 2015

Accepted 30 March 2016

Available online 7 July 2016

Keywords:

Fire safety

Disaster risk management

Cultural heritage

Risk-informed alternatives

Life safety

Fire hazards

ABSTRACT

Disasters are increasing globally. Their adverse impacts on lives and livelihoods, and regional and local economies are felt more and more. Losses to both our tangible and intangible cultural heritage during these disasters are increasing as well. These losses include those to sites, structures and artifacts of cultural significance, as well as impacts to cultural tourism and the financial resources these sites introduce to local communities. While most disasters cannot be prevented, pre-planning measures can significantly help mitigate and effectively reduce their impact. In addition, focusing on disaster risk reduction prior to events, one can help limit spending large sums of money in post-disaster recovery. Therefore, through developing prevention and mitigation measures, emergency response and disaster recovery procedures that are tailored to the individual sites and structures, losses could be further limited. There are numerous mitigation and prevention measures that can be implemented to help limit the loss to our collective cultural heritage. While there are some hazards that it may be challenging to totally mitigate against, there are a significant amount of low cost/high impact prevention and mitigation measures that could be put into place to help reduce these losses. In light of this, this paper will research information related to why hazards develop into disasters, and investigate a detailed, risk-informed approach to better address these hazards particularly related to fire and more effectively and efficiently protecting our cultural heritage.

© 2016 Elsevier Masson SAS. All rights reserved.

1. Introduction and research aims

Disasters including fires continue to present challenges for historic structures. We continue to lose not only historic buildings, but also historic ships, bridges, monuments and other historic structures and their valuable contents to these disasters [1–3]. Losses due to secondary events such as fires following earthquakes create significant losses as well.

By studying these events, a significant amount can be learned including understanding why fires started, how they progressed, what failed, and what worked so one can better prepare a disaster mitigation plan.

Common themes arise when assessing these fires:

- numerous ignition sources;
- renovation work;
- fire protection systems not present, or operational;

- delays in notifying fire brigades;
- limited fire safety awareness and training.

By understanding these, significant steps can be made to mitigate fire risks. In addition, by applying a risk-informed approach, multiple benefits arise including:

- minimizing aesthetic impact;
- incorporate effective fire protection provisions;
- meet intent of codes;
- using traditional materials/skills;
- using local knowledge systems;
- increased local awareness/building capacity;
- developing maintenance/monitoring strategies for reducing risks to cultural heritage.

The objective of this paper therefore is to provide results of research related to lessons from recent disasters, and the development of an overall framework of an approach including identifying prevention and mitigation measures to help protect historic structures from fire. This research can be applied to other types of

* Tel.: +001 646 642 1265.

E-mail address: chris.marrion@marrionconsulting.com

URL: <http://www.marrionconsulting.com>.

disasters. For this paper, fire has been used as the primary example for this research.

2. Considerations in the development of a disaster risk management strategy

When developing comprehensive disaster management strategies, it is important one considers lessons learned from the past disasters, and that one develops sustainable solutions embracing indigenous traditions. This then can be incorporated into an overall risk-informed framework in developing an appropriate disaster mitigation strategy that is tailored to the specific structure.

2.1. Gaining knowledge from past disasters and fires

Natural, as well as man-made, disasters continue to destroy our cultural heritage. There is a significant amount that can be learned by studying these events and what led to these significant losses. This includes understanding why fires started, how they progressed to such a significant magnitude, what failed, what worked so one can better prepare a disaster mitigation plan to help not only preventing fires, but limiting the extent of loss should a fire occur, in addition to developing effective disaster response plans after the incident has occurred [4–6].

In studying recent fires in cultural heritage buildings and structures, there are a number of common threads that continue to appear. These include:

- several ignition sources are present (open flames, electrical, lighting, etc);
- restoration work presents new ignitions sources and combustible materials;
- fire protection systems/features not operational, if even present;
- combustible materials include the construction elements, as well as the interior finish and contents, and support spread of fire throughout the structure;
- fires start and grow undetected as there is typically no automatic fire detection;
- fires continue to grow as no automatic suppression systems;
- delays in notifying fire brigades as there is no detection system or manual means or instructions to notify them;
- limited/no local fire brigade, very limited manual suppression capability, capacity, equipment and experience at the site;
- limited/no compartmentation allows fire and smoke to spread;
- typically limited fire safety awareness and education.

As one begins to see these trends, a significant step can be made to mitigate fire risks.

2.2. Disasters are not sustainable

It needs to be noted that fire and other disasters are not sustainable [7,8]. When an historic structure burns, this impacts our heritage and adversely impacts sustainability as toxic products are given off to the atmosphere, wetlands and earth. Having to rebuild adds further to fire's non-sustainability as new resources are needed. Appropriately addressing fire and sustainability during upgrade/renovation work, significantly limits the impact on the magnitude of a disaster, the response required, and ultimately resources needed and investments to recover, while at the same time better protecting our heritage.

Disaster preparedness can induce non-sustainable solutions that impact heritage if not addressed appropriately (e.g. upgrading walls that codes require be fire rated). In addition, not properly designing these systems, comprehending building operations/testing further impacts sustainability. Fire and sustainability

therefore need to be assessed together. This includes limiting fire occurring, reducing its size, limiting building/environmental impact from fire. It is critical one develops a strategy to meet sustainability, fire safety and preservation objectives, and addresses system integration, alternate design methods and develops economically viable, safe and sustainable buildings, including:

- inherent existing material properties should be incorporated and not replacements;
- integrate systems (smoke management/HVAC);
- suppression systems (non-ozone depleting, low water usage);
- fire fighting (limit fire size/water needed, control water runoff);
- performance of recycled/existing materials;
- local resources and indigenous techniques.

2.3. Cultural heritage & indigenous traditions

When undertaking disaster mitigation planning assessments, it is important that one embraces indigenous traditions and cultural heritage [9]. These not only help to maintain the overall local culture and traditions, but also are more likely to be implemented and maintained over time. This may include maintaining local traditions (i.e., butter lamps/candles), trying not to limit the numbers of people at ceremonies and events while providing safe egress, using traditional construction materials and techniques, traditional firefighting techniques and suppression agents (water, dirt, sand etc.).

2.4. Approaches to disaster planning

Typically, there are two ways used to develop a disaster mitigation plan with regards to fire: prescriptive or performance based [10]. The prescriptive approach uses traditional building and fire codes, while the performance approach sets objectives, assesses hazards, develops alternatives and evaluates these against the hazards to see if the objectives are met. In using the prescriptive code approach, while there are benefits, there may also be challenges that one faces implementing them, including:

- developed around past fires and are more reactive than proactive;
- potential limited applicability to protecting historic structures;
- adverse impact on historic fabric and on aesthetics;
- effectiveness – results typically not quantified;
- various aspects of fire safety are generally addressed independently of one another;
- may fall short of meeting one's fire/life safety objectives.

Several of these challenges can be addressed via the performance based, risk-informed approach.

3. Methodology: risk informed/performance based approach methodology

3.1. Overview

A fire strategy that is successful depends on integrating many fire/life safety systems and for these to function together in an event (i.e. sprinkler system operates and activates the fire alarm which notifies occupants, and releases doors on automatic door closers). It is important that the inter-relationship between all fire safety features and systems be understood and an integrated approach is adopted. One way to ensure this is by adopting a performance-based approach. Based on past experience with historic buildings, this integrated approach often results in several benefits, including:

Download English Version:

<https://daneshyari.com/en/article/1037833>

Download Persian Version:

<https://daneshyari.com/article/1037833>

[Daneshyari.com](https://daneshyari.com)