Multi-Hazard Risk and Asset Value Assessment of Heritage Buildings (Case Study in Iloilo City, Philippines)

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Summary

Heritage buildings belong to the most vulnerable class of structures because of the material degradation and the lack of structural design present. With the increasing frequency and magnitude of disasters, the need to preserve heritage buildings is further underlined. The risk assessment method considered various risks and the inclusion of the heritage building asset value. The pilot study in Iloilo was able to create a shortlist of "prioritized" heritage buildings for preservation.

Keywords: heritage buildings, rapid visual screening, prioritized preservation, risk assessment

1. Introduction

1.1 Risk assessment for heritage buildings

Heritage buildings are key to our identity as a people. However, the upkeep and preservation of heritage buildings is made difficult because of the vulnerability of these structures due to non-application of structural design codes [1] and material deterioration [2]. In addition to this, most of the existing rapid screening procedures do not account for the material deterioration and the cultural heritage value of the building. In response, the developed risk assessment tool accounts for both aforementioned aspects.

1.2 Defining risk for heritage buildings

Risk is a play between hazard as the harmful event, vulnerability as the capacity of the asset to withstand the harmful event and the importance of the asset itself [3]. These three form the basic risk equation used to derive a risk index for each heritage building. An aggravating factor, M, is added to modify the vulnerability score.

$$Risk = Hazard \times Vu\ln erability \times Asset \quad (1)$$

$$V' = V(1+M) \quad (2)$$

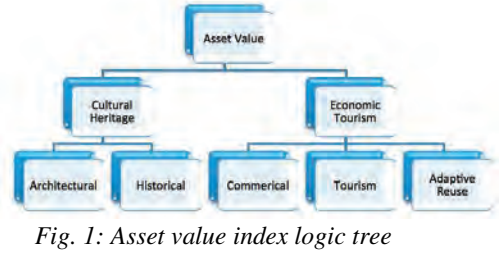

Fig. 1: Asset value index logic tree

$$A = (w_1 \times CHI) + (w_2 \times ETI) \quad (3)$$

2. Asset value assessment for heritage buildings

Heritage buildings are irrecoverable assets with priceless value, emanating from a shared cultural value of history, art or science. From these definitions, heritage buildings are classified in five key values, clustered in two different categories (figure 1). Equation 3 is used to calculate the asset value index.

3. Hazard and vulnerability assessment for heritage buildings

Considering the hazards of fire, seismic and extreme conditions, key parameters quantifying the level of risk for each component of risk are listed in table 1. The three hazards are considered mutually exclusive. Each key parameter is given a score of 3, 2 or 1 based on a rubric. Weights for each key parameter are also taken through an AHP survey among experts.

Table 1: Summary of key parameters for each hazard

Type of Risk		
Fire	Extreme Wind	Seismic
Hazard		
Building Use	Basic Wind Speed	Distance to Fault Line
Electrical Wiring	Building Vicinity	Seismic Source Type
	Soil Condition	Soil Condition
Vulnerability		
Roof Material	Type of Roof Design	Year of Construction
External Walls Material	Slope of Roof	Plan Irregularity
Internal Walls Material	Number of Floors	Vertical Irregularity
Flooring Material	Roof Material	Provision for Seismic Gap
Flammable Substances	Building Enclosure	Number of Floors
Combustible Substances	Building Material	Building Material
Explosive Substances	Type of Structural Framing	Number of Bays
	Plan Irregularity	Column Spacing
	Vertical Irregularity	
Mitigation/Modifiers		
Ease of Access to Building	Overhangs	Time Deterioration
Fire Suppression System	Parapets	Force Load Path Continuity
	Force Load Path Continuity	Architectural Elements
	Material Condition	Type of Framing

4. Results and Conclusion

4.1 Pilot Study in Iloilo City

The City of Iloilo is located in the Visayas group of Islands, central Philippines. Iloilo city is considered as one of the oldest cities in the country. Realizing the importance of preserving these heritage structures, the city government has actively pursued the advocacy of promoting the city's culture.

In support of these efforts, the developed methodology was pilot tested in the CBD area. Through this, the heritage buildings were ranked for deeper investigation and preservation based on the heritage building value and hazard-vulnerability assessment (figure 2, below).

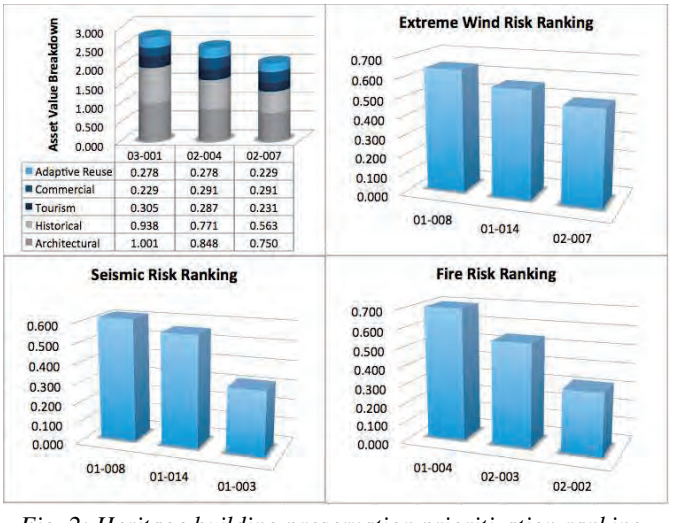

Fig. 2: Heritage building preservation prioritization ranking.

4.2 Conclusion

The pilot study made in the City of Iloilo has shown the lack of an institutionalized clear-cut system of prescribing the order of preservation, based on structural aspects against multi-risks and the cultural aspects of a heritage building. To this regard, the proposed methodology is able to provide an efficient and objective prioritization and preservation management tool that integrates both the cultural heritage and the structural aspects against various risks. In the end, both life and cultural heritage are saved.

5. References

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