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EDITORIAL

Risk and Resilience in Practice: Cultural Heritage Buildings

The recent occurrence of devastating natural and man-made hazardous events has raised the awareness of numerous international institutions connected to disaster risk reduction (DRR) and disaster risk management (DRM). The development of new risk assessment and mitigation strategies is, therefore, internationally encouraged, particularly by focussing on the identification of the most vulnerable elements to reduce their vulnerability, while enhancing preparedness and recovery capacity. In the particular case of cultural heritage, international frameworks and programmes for DRR are increasingly echoing concerns about its protection from disasters given its irreplaceable value for society. Coherent recommendations for assessing and mitigating disaster risk in the built cultural heritage should, therefore, be considered a priority. Still, in order to be able to define more adequate mitigation strategies and outline appropriate conservation and restoration interventions that will reduce vulnerabilities and enhance the overall resilience, the protection of cultural heritage buildings should be based on a comprehensive knowledge of risks.

"*How to define, prioritise and implement efficient risk reduction strategies taking into account different issues arising from scale-related aspects (a single heritage asset versus a historic area)*?", "*How to balance the use of modern technologies, traditional techniques and/or hybrid solutions to safeguard architectural heritage while ensuring acceptable levels of risk*?" and "*How to manage and deal with the multidisciplinary character of cultural heritage buildings restoration and recovery processes (involving several actors with very different roles, backgrounds and spheres of action)?*" are some of the questions addressed by this Special Issue that contribute to a better understanding of risk and resilience issues in cultural heritage buildings. Simultaneously, the contributions included in this Special Issue are also expected to strengthen the development of prevention, preparedness and response actions to reduce the impact of disasters in cultural heritage buildings, following the priorities established by the Sendai Framework for Disaster Risk Reduction 2015–2030, the 2030 Agenda for Sustainable Development and the United Nations Framework Convention on Climate Change.

The contents of this Special Issue include a selection of ten high-quality articles resulting from a Track organised by the guest editors as part of the 8th International Conference on Building Resilience, which was held in Lisbon, Portugal, on November 7–9, 2018.

English et al. (2020) address the topic of building resilience through flood risk reduction by providing an overview of amphibious retrofit solutions and their application to the preservation of historic buildings and neighbourhoods. Several case studies are presented in the article, namely, retrofits of heritage buildings in the historically significant African-American community of Princeville, North Carolina; of a low-income neighbourhood of freedman's cottages in Charleston, South Carolina; and of a creative approach for amphibiating architect Ludwig Mies van der Rohe's iconic Farnsworth House in Plano, Illinois. The article further connects to broader themes of developing innovative and practical methods for providing flood protection to heritage structures, using an approach that emphasises sensitivity and adaptability to the cultural values of existing communities.

Revez et al. (2020) propose an innovative decision-support tool, known as Cost-Effectiveness Analysis (CEA), to support decisions regarding the conservation of archaeological heritage facing natural or anthropogenic risks, including those amplified by climate change. Among other relevant aspects, this methodology allows comparing different strategies without the need to monetise the expected outcomes. The basis of the methodology is described and discussed in the article, as well as its application to the Roman Ruins of Tróia (Portugal), where five strategies addressing the risk of a dune weighing upon a Roman well were assessed.

Canuti et al. (2020) present a comprehensive analysis of observational damage from post-earthquake investigations carried out in churches of the Marche Region struck by the 2016 Central Italy seismic sequence. Collected data is processed to provide insights into the damage that occurred and to evaluate the vulnerability of the religious buildings of the region. The research presents an overview of the architectural typologies to establish a classification of the sample of

churches that are considered. The most recurring damage mechanisms are then identified, and a global damage index is also computed for each church. Finally, the overall damage of the sample is compared to that estimated using empirical models available in the literature and comparisons with the results of previous studies are also provided.

Marra et al. (2020) provide an insight on the central issues related to the integration of different skills and new technologies based on the capabilities offered by Information and Communication Technologies (ICT) in the preservation process of historical buildings. An explanatory case is discussed to establish the basis for an approach that integrates ICT systems and structural monitoring techniques for the preservation of cultural heritage. A SWOT analysis is also innovatively used to provide interdisciplinary support for the definition of proactive conservative plans.

Ponte, Bento, and Vaz (2020) present a multidisciplinary approach for the seismic behaviour assessment of built cultural heritage. The Nacional Palace of Sintra, which is located within the Cultural Landscape of Sintra, a UNESCO World Heritage Site since 1995, is used as a pilot case study. The historical background and the visual structural in-situ survey are discussed in the article, as well as a series of experimental tests which are subsequently used to develop calibrated numerical models. Finally, a 3D architectural model of the palace using a building information modelling approach is presented and discussed, along with some key considerations and recommendations related to the numerical modelling and the seismic behaviour analysis of the palace.

Morais, Vigh, and Krähling (2020) examine the effects of the 1763 Komárom earthquake (Hungarian Kingdom) by analysing historical building archetypes using both Nonlinear Static Analysis (NSA) and Incremental Dynamic Analysis (IDA). While NSA is conducted using the Tremuri software, the IDAs are carried out using the OpenSees software using a simplified macro-modelling approach that uses a calibrated Pinching4 hysteretic material model to simulate the masonry walls. Based on this modelling approach, fragility functions are then developed to estimate the magnitude of the 1763 Komárom earthquake.

Romão and Paupério (2020) propose a new indicator that provides a quantitative estimate of the loss in value of cultural heritage assets damaged by hazardous events. The loss in value is estimated as a function of the (physical) damage that cultural heritage assets sustained and of the positive estimated economic impact that cultural heritage has in a given country or region. The authors present details of the methodology, along with an illustrative application to a case study.

Granda and Ferreira (2020) assess and discuss the fire risk in the Historic Centre of Quito, one of the oldest and most relevant Spanish colonial settlements in South America. In order to tackle the difficulties inherent to the scale of the case study, the evaluation is carried out at the neighbourhood scale, through the application of a simplified fire vulnerability and risk assessment methodology. Fire vulnerability and risk indicators are presented in the form of vulnerability maps, which are then combined with pre-existing vulnerability data in order to identify a range of possible risk mitigation strategies targeting different objectives.

Martins et al. (2020) investigate disaster risk and resilience in the case of the historic city centre of Lisbon-downtown (*Baixa Pombalina*), a place famous for its reconstruction as a new disaster-resistant city following the devastating earthquake of 1755. The research recognises the importance of both the city's tangible and intangible heritage and the impact of changes in the urban fabric since 1755, including the city's changing social and economic context. By cross-referencing historical and physical sources and utilising GIS-mapping techniques, the authors investigate how the current inner-city would respond to a new catastrophic hazard. Through fieldwork, the team analyse how the emergence of tourism has led to increased vulnerability and additional disaster risk. From a transdisciplinary standpoint, the authors also offer a framework for developing a suitable research methodology and disaster risk management plan for other historic urban areas.

Finally, after providing a comprehensive review of existing strategies for improving resilience and energy efficiency of the built heritage, Posani, Veiga, and de Freitas (2020) specify a hygric criterion for classifying insulation materials and propose a method for performing fast, preliminary assessment of their compatibility with built heritage components. This method, together with the hygric classification, offers a comprehensive tool for performing the choice of suitable insulation materials at the preliminary stage of the intervention design.

The editors would like to express their sincere gratitude to the authors, who have generously shared their scientific knowledge and experience through their contributions, to the peer reviewers, who have significantly contributed to enhance the quality of this Special Issue, and to Professor Pere Roca for his support. Finally, the editors hope the readers of the *International Journal of Architectural Heritage* will appreciate the contents of this Special Issue.

Disclosure statement

No potential conflict of interest was reported by the author.

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