

XII International Conference on Structural Analysis of Historical Constructions– SAHC2020

Development of a Fire Vulnerability Index for Immovable Cultural Heritage

L. Gerardo F. Salazar* Esmeralda Paupério[†] and Xavier Romão[†]

*CONSTRUCT-LESE, Faculty of Engineering - University of Porto (FEUP)
Rua Dr. Roberto Frias, 4200-465 Porto, Portugal
Email: gsalazar@fe.up.pt

[†] Construction Institute, CONSTRUCT-LESE, Faculty of Engineering - University of Porto (FEUP)
Rua Dr. Roberto Frias, 4200-465 Porto, Portugal
Email: pauperio@fe.up.pt

[†] CONSTRUCT-LESE, Faculty of Engineering - University of Porto (FEUP)
Rua Dr. Roberto Frias, 4200-465 Porto, Portugal
Email: xnr@fe.up.pt

ABSTRACT

Fires affecting cultural heritage assets have recently been at the centre of international attention as a consequence of multiple events that recently occurred, namely those of the National Museum of Rio de Janeiro (Brazil) in 2018, and at the Cathedral of Notre Dame (France) in 2019. Available fire risk assessment approaches are mostly developed for new buildings and target the protection of people, properties, and contents. These approaches encompass minimum provisions defined by standards that are valid in certain countries, and few of these methods were thought exclusively for assessing the fire safety of cultural heritage. To overcome these limitations, since the diversity of cultural heritage assets, simple approaches are required to be able to rank the fire safety of multiple heritage assets, through the establishment of priorities for risk mitigation measures. Therefore, approaches based on vulnerability indicators are likely to offer advantages since they are expected to be easier to implement.

In this context, the proposed paper presents a simplified fire vulnerability index dedicated to assessing the fire vulnerability of immovable cultural heritage assets. The fire vulnerability index is presented for the particular case of single cultural heritage buildings that can host movable heritage, collections or have other heritage elements attached to the building. The proposed index is the result of a weighted multi-parameter evaluation and is expected to provide information that can be correlated with the level of damage that the cultural heritage asset (including its contents) is expected to suffer under a fire. The proposed index involves twenty-one parameters divided into four categories ('i.e.' building properties; electrical, gas and telecommunication equipment; auxiliary fire-fighting equipment; and protection planning for cultural assets) and offers a flexible approach for universal applicability. The selected parameters are based on an extensive review and adaptation of existing methods for fire vulnerability and risk assessment that were not developed exclusively for cultural heritage. The performance of the proposed approach is illustrated by applying it for three constructions of the Route of the Romanesque, in Portugal. The results highlight the advantages of having a simple methodology that can be used for the preliminary risk analysis of a large number of assets to establish risk mitigation priorities, or to identify assets requiring more detailed and resource-demanding analyses.