# Risk management and criticality ranking of civil infrastructures – case study

**Oscar Urbina, Elisabete Teixeira, Hélder Sousa, José Matos**

*University of Minho, ISISE, Department of Civil Engineering, Guimarães, Portugal*

**Contact:** oscarj105@gmail.com

## Abstract

One of the most important prerequisites for the critical Infrastructure's risk management is the study of the collateral effects between different critical Infrastructures (CI) to obtain a critical index that indicates which CI requires more effort in terms of budget and studies, i.e., ranking the criticality of the Infrastructures. Therefore, this article presents a brief literature review of the state of the art that was conducted regarding the methodologies and models for the critical infrastructure's risk management and the importance of categorizing its level of risk and the criticality of each infrastructure. This paper consists of three main parts i) A short introduction on the background and importance of this study; ii) a brief display and explanation of the inspected methodologies for risk management and the quantification of the criticality of CI; iii) implementation of the selected methodologies applied on a case study situated in the north of Portugal applied to Fire Risk.

**Keywords:** Risk management models; Risk analysis; Critical Infrastructures; Criticality Ranking; Criticality Index; Fire risks; Bayesian Probabilistic Networks.

## 1 Introduction

As a result of urbanisation, economic globalization, and the spread of information through technology, the population is now highly dependent on the mass-distribution of information, goods, and services [1]. Influencing the welfare, security and economy of every country subjected to the performance of its infrastructures [2]. This demonstrates the importance of Critical Infrastructures, as they facilitate society's functions and services, e.g. financial services and emergency services, energy and water supply [3]. In addition, the hazards that may potentially threaten Critical Infrastructures have increased, they can be classified as: naturally caused, human made, or due to technological reasons that could strongly affect their functionality [4], [5].

Risk is the combination of probability of occurrence and its consequences, and its analysis is commonly used to prioritize the strategies to mitigate problems in Critical Infrastructures, because of the limited resources and budget, making it an important tool for the stakeholders for the planning and decision making of the management of these risks in Critical Infrastructures. There are a several number of risk analysis and management models but commonly they are compounded by an identification of threats, consequently with a recognition of the vulnerabilities of the CI and an assessment of the possible impacts. Nevertheless, there is quite a difference between these methodologies and the application target they follow and its area of applicability [6]. Furthermore, it is of vital importance to distinguish which Infrastructures are critical, and which are not, allowing a nation to distribute efficiently its limited

https://doi.org/10.2749/ghent.2021.1779
Distributed by structurae