Chapter 15

ASSESSING POTENTIAL CASUALTIES IN CRITICAL EVENTS

Simona Cavallini, Fabio Bisogni, Marco Bardoscia, and Roberto Bellotti

Abstract This paper describes an approach for assessing potential casualties due to events that adversely impact critical infrastructure sectors. The approach employs the consequence calculation model (CMM) to integrate quantitative data and qualitative information in evaluating the socio-economic impacts of sector failures. This is important because a critical event that affects social and economic activities may also cause injuries and fatalities. Upon engaging a structured method for gathering information about potential casualties, the consequence calculation model may be applied to failure trees constructed using various approaches. The analysis of failure trees enables decision makers to implement effective strategies for reducing casualties due to critical events.

Keywords: Cascading effects, consequence calculation, casualties, failure trees

1. Introduction

The European Commission Directive 2008/114/EC of 2008 [5] defines a critical infrastructure as “an asset, system or part thereof located in member states which is essential for the maintenance of vital societal functions, health, safety, security, economic or social well-being of people, and the disruption or destruction of which would have a significant impact in a member state as a result of the failure to maintain those functions.” The directive clarifies a European critical infrastructure as one that is located in a European Union (EU) member state whose destruction or malfunction would have a significant impact in at least two EU member states. The significance of the impact should be assessed in terms of cross-cutting criteria, including the effects of cross-sector dependencies involving other infrastructures.

According to Article 3 of Directive 2008/114/EC [5], the identification process of each member state should be based on the following cross-cutting criteria:
- **Casualties Criterion:** Assessed in terms of the potential numbers of fatalities and injuries.

- **Economic Effects Criterion:** Assessed in terms of the significance of economic loss and/or degradation of products and services, including potential environmental effects.

- **Public Effects Criterion:** Assessed in terms of the impact on public confidence, physical suffering and disruption of daily life, including the loss of essential services.

To define and identify critical infrastructures at the national level, each EU member state has adopted a perspective that can be related to one of the following approaches [2]: (i) service-oriented approach, in which the key elements are vital services and/or essential societal functions; (ii) asset-oriented approach, in which the key elements are impact and/or risk assessment; and (iii) operator-oriented approach, in which the key elements are public/private organizations that manage/own infrastructures because of their decision-making role.

A sector-based approach may be considered close to an operator-oriented approach when, in a given area, the number of operators is limited (i.e., natural oligopoly or monopoly) and/or the opportunity to replace their services is difficult in the short term. In this perspective, a critical infrastructure corresponds to key elements of a productive sector at the national level, where the sectors must be identified using official statistical classifications such as NACE in the EU context.

The malfunction or destruction of an infrastructure, especially due to an unexpected event, affects social and economic activities. The relevance of critical infrastructure failures is, in general, not only due to their direct role in socio-economic activities, but also because of their interconnections. Tight interconnections among critical infrastructures and the cascading effects that can occur in the case of failures of one or more infrastructures have been extensively investigated at the theoretical [1, 4] and empirical levels [12]. In both cases, strong connections have been identified in certain sectors that can cause cascading effects in specific cases.

With regard to preventive actions and crisis management, civil protection authorities and first responders would benefit from a preliminary assessment of potential damage caused by accidental or intentional failures of socio-economic sectors. According to an intervention perspective related to the emergency roles of civil protection personnel and first responders, the focus is on evaluating the impacts, especially casualties, in the time frame starting from the end of the direct effect of the event of interest.

This paper describes the consequence calculation model (CCM), which integrates quantitative data and qualitative information in order to evaluate the socio-economic impacts of sector failures. The model has been developed by the FORMIT team and applied in the DOMINO Project [10]. The concrete application of the model provides indications of priorities of intervention in