Impact evaluation of human-made hazards on terrestrial transport infrastructure assets: modelling variables and failure modes

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Abstract

This work provides an overview of human-made hazards impact on the malfunctioning of terrestrial transportation systems. The impacts evaluation is gathered in four major groups, specifically: human, economic, environmental and political/social impacts. For further characterization or forecast of human-made hazards impact in real case scenarios, a traditional risk assessment framework is proposed by assuming four main steps: i) hazard identification; ii) probability of occurrence; iii) asset vulnerability; iv) impacts. The present work was carried within the SAFEWAY project, which aims at improving the resilience of transport infrastructures, developing a holistic toolset with transversal application to anticipate and mitigate the effects of extreme events at all modes of disaster cycle.

Keywords: human-made hazards; transportation networks; risk assessment; impact quantification.

1 Introduction

Management systems and decision-making processes for transportation network assets often rely on risk assessments as means to define preparedness, response and recovery to extreme events. The impact evaluation of a hazard in a given system is under the scope of a risk analysis. In that case the first necessary step focr a risk assessment is the definition of the system itself and the scope of the assessment. Having this in mind, the current work highlights the assessment made to transportation infrastructure network systems damaged by human-made hazards. In this sense, a human-made hazards are disastrous or disorder events caused by men or women activity, as users of terrestrial transportation network leading in many cases to negative outcomes. For an adequate risk assessment, it is imperative the definition of exposure, vulnerability and the robustness of the system, being the last two, a feature of the system responsible for higher or lower direct and indirect consequences, given the same hazard magnitude. On one hand, with higher vulnerability of the system it is more likely to have a larger number of fatalities and injuries occurrence and increased costs of restoration of the system. On the other hand, for the lack of robustness of the system it is often attributed the increase of indirect consequences such as the cost of disruption of the economy and immediate and long-term emergency measures.

This research is developed within the European project SAFEWAY [1], which main goal is to design and implement holistic methods, strategies, tools and technical interventions to significantly increase the resilience of inland transport infrastructure by reducing its vulnerability and strengthening network systems to extreme events (natural and human-made). For achieving the SAFEWAY project goals, one of its working package aims at identifying risk factors (natural and human-made) and vulnerabilities in order to provide an updated inventory of hazards and their impacts. Within this

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