



The impact of natural hazard on critical infrastructure systems: definition of an ontology

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According to the Council of the European Union Directive (2008), 'critical infrastructure' means an asset, system or part thereof 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 as a result of the failure to maintain those functions. Critical infrastructure networks are exposed to natural events, such as floods, storms, landslides, earthquakes, etc. Recent natural disasters show that socio-economic consequences can be very much aggravated by the impact on these infrastructures. Though, there is still a lack of a recognized approach or methodology to assess the vulnerability of critical infrastructure assets against natural threats. The difficulty to define such an approach is increased by the need to consider a very high number of natural events, which differ in nature, magnitude and probability, as well as the need to assess the vulnerability of a high variety of infrastructure assets (e.g. bridges, roads, tunnels, pipelines, etc.)

To meet this challenge, the objective of the THREVI2 EU-CIPS project is to create a database linking the relationships between natural hazards and critical infrastructure assets. The query of the database will allow the end-users (critical infrastructure protection authorities and operators) to identify the relevant scenarios according to the own priorities and criteria. The database builds on an ontology optimized for the assessment of the impact of threats on critical infrastructures. The ontology aims at capturing the existing knowledge on natural hazards, critical infrastructures assets and their related vulnerabilities. Natural phenomena that can threaten critical infrastructures are classified as "events", and organized in a genetic-oriented hierarchy. The main attributes associated to each event are the probability, the magnitude and the "modus". The modus refers to the physical-chemical process by means the event (e.g., a pyroclastic flow) can interact and damage a critical infrastructure asset (e.g., a pipe). Each event can be characterized by several modi (e.g., impact load, heating, burying) that can cause damages to the asset. Hence, the damage is linked to the modus and not directly to the event. The advantage of using the "modus" approach is to allow reducing the number of interactions (natural hazard/Critical infrastructure assets) to be addressed. All different events exert their impact on infrastructures by means of a limited number of different modus. This allows adapting existing vulnerability or fragility laws to events that have not been studied yet, and for which these laws are not available.