

## **People at risk – nexus critical infrastructure and society**

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Strategic infrastructure networks include the highly complex and interconnected systems that are so vital to a city or state that any sudden disruption can result in debilitating impacts on human life, the economy and the society as a whole. Recently, various studies have applied complex network-based models to study the performance and vulnerability of infrastructure systems under various types of attacks and hazards – a major part of them is, particularly after the 9/11 incident, related to terrorism attacks. Here, vulnerability is generally defined as the performance drop of an infrastructure system under a given disruptive event. The performance can be measured by different metrics, which correspond to various levels of resilience.

In this paper, we will address vulnerability and exposure of critical infrastructure in the Eastern Alps. The Federal State Tyrol is an international transport route and an essential component of the north-south transport connectivity in Europe. Any interruption of the transport flow leads to incommensurable consequences in terms of indirect losses, since the system does not feature redundant elements at comparable economic efficiency. Natural hazard processes such as floods, debris flows, rock falls and avalanches, endanger this infrastructure line, such as large flood events in 2005 or 2012, rock falls 2014, which had strong impacts to the critical infrastructure, such as disruption of the railway lines (in 2005 and 2012), highways and motorways (in 2014). The aim of this paper is to present how critical infrastructures as well as communities and societies are vulnerable and can be resilient against natural hazard risks and the relative cascading effects to different compartments (industrial, infrastructural, societal, institutional, cultural, etc.), which is the dominant by the type of hazard (avalanches, torrential flooding, debris flow, rock falls). Specific themes will be addressed in various case studies to allow cross-learning and cross-comparison of, for example rural and urban areas, and different scales. Correspondingly, scale-specific resilience indicators and metrics will be developed to tailor methods to specific needs according to the scale of assessment (micro/local and macro/regional) and to the type of infrastructure.

The traditional indicators normally used in structural analysis are not sufficient to understand how events happening on the networks can have cascading consequences. Moreover, effects have multidimensional (technical, economic, organizational and human), multiscale (micro and macro) and temporal characteristics (short- to long-term incidence). These considerations will guide to different activities:

- 1) computation of classic structural analysis indicators on the case studies in order to obtain an identity of the transport infrastructure and;
- 2) development of a set of new measures of resilience.

To mitigate natural hazard risk a large amount of protection measures of different typology have been constructed following inhomogeneous reliability standards. The focus of this case study will be on resilience issues and decision making in the context of a large scale sectorial approach focused on transport infrastructure network.