



RiskBox - a toolbox for the risk analysis of natural hazards

Mi. Baruffini (1), Mo. Baruffini (1), M. Thuring (1) and M. Cannata (1)

(1) Institute of Earth Sciences, University of Applied Sciences of Southern Switzerland, IST-SUPSI, C.P. 72, CH-6952 Canobbio (ist@supsi.ch)

Reliable infrastructures provide a wide range of essential services for the functioning of the modern economy and society. Interruptions of the Swiss railway power supply and closures of the Gotthard highway due natural hazards and street accidents that occurred in the last years have increased the awareness of infrastructure vulnerability also in Switzerland and illustrate the potential impacts of failures on the performance of infrastructure systems.

As part of the Swiss National Science Foundation Project 54 “Evaluation of the optimal resilience for vulnerable infrastructure networks - An interdisciplinary pilot study on the transalpine transportation corridors”, a research project that proposes to investigate the vulnerabilities of transportation infrastructure systems due to extraordinary impacts caused by natural hazards, technological failures and intentional impacts, we particularly study the vulnerability of infrastructures due to natural hazards.

Risk analysis has become indeed a generally accepted approach for the assessment of risk scenarios. Originating from technical risks it is being applied to natural hazards for several years now in Switzerland (Loat & Zimmermann 2004; OFAT, OFEE, OFEFP 1997).

The so-called Swiss system for risk analysis (BUWAL 1999) offers a rather complete framework for the analysis and assessment of risks due to natural hazards, ranging from hazard assessment for gravitational natural hazards, such as landslides, collapse, rockfall, flooding, debris flows and avalanches, to vulnerability assessment and risk analysis, and the integration into land use planning at the cantonal and municipality

level. BUWAL 1999 though is limited to the assessment of the direct consequences of natural hazards.

The objective of the research is to develop a system which integrates the procedures for a complete risk analysis in a Geographic Information System (GIS) toolbox, in order to be applied to our testbed, the Alps-crossing corridor of Saint Gotthard.

The simulation environment is called RiskBox and has several modules, identifying the consecutive steps of risk analysis: hazard - vulnerability - risk. As technological choice the open-source GIS environment GRASS (Geographic Resources Analysis Support System) was identified. GRASS is suitable for a wide variety of different analyses including Risk Analysis and Risk Evaluation.

The design of the toolbox includes the following elements for the modules hazard, vulnerability and risk:

- Module hazard integrates applications to simulate natural hazard processes in order to assess their hazardness (Raetzo et al. 2002);
- Module vulnerability integrates vulnerable objects and attributes them with the necessary meta-data (Hollenstein et al. 2002);
- Module risk integrates the necessary analysis approaches in order to conduct the risk analysis based on the former two modules.

The toolbox exists as a functional prototype. It is very flexible and can be used as a simple program to model the expansion of natural hazards, as a program of qualitatively estimate risks or as a detailed analysis at a municipality level. The toolbox is extensible and can be expanded with additional modules.

The final goal of RiskBox is to have a versatile tool for risk analysis which can be applied to other situations.

We present the concept and the current state of development of RiskBox and its application to the testbed, the Alps-crossing corridor of Saint Gotthard.

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