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SEISMIC VULNERABILITY ASSESSMENT OF INFRASTRUCTURES AND SOCIO-ECONOMIC IMPACTS: GENERAL METHODOLOGY

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SYNER-G (2009-2012) is a European collaborative research project funded by European Commission (Seventh Framework Program, Theme 6: Environment). Its primary purpose has been the development of an integrated methodology for the systemic seismic vulnerability and risk analysis of infrastructures.

From a system-theoretic point of view, an infrastructure is a system of systems (SOS), i.e. a super-system containing a number of sub-systems, such as buildings, lifelines (e.g. water, power, gas, transportation networks) and critical facilities (e.g. health-care facilities). The infrastructure constitutes the physical layer supporting the life of modern societies and its reliable operation is essential to our safety, health and all socio-economic activities: this is the reason why it is commonly termed "critical infrastructure" (CI).

The innovative methodological framework developed in SYNER-G allows the assessment of physical as well as socio-economic seismic vulnerability and risk of an infrastructure at the urban/regional scale. The framework allows for pre-event performance assessment for the immediate aftermath of the event, i.e. with a goal of forecasting the short-term impact, when the damaged infrastructure operates in a state of emergency, in order to prepare mitigation measures. As a consequence, the target beneficiaries/stakeholders are emergency managers.

The built environment is modelled according to a detailed taxonomy of the different systems. The framework encompasses in an integrated fashion all aspects in the chain, from seismic hazard to the vulnerability assessment of components and systems and to the socio-economic impacts of an earthquake, accounting for all relevant uncertainties through an efficient quantitative simulation scheme. Interactions between components within the same system and between different systems (intradependencies and interdependencies, respectively) are modelled.

The methodology has been implemented in an open source software tool and tested with reference to selected sites and systems at urban and regional scale: the city and the harbour of Thessaloniki (Greece), the city of Vienna (Austria), the gas system of L'Aquila (Italy), the electric power network of Sicily, the roadway network of Calabria region (Italy) and a hospital facility in Italy.

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