15TH WORLD CONFERENCE ON EARTHQUAKE ENGINEERING

SPECIAL SESSION SS 24.2

SYNER-G

SYSTEMIC SEISMIC VULNERABILITY AND RISK ANALYSIS FOR BUILDINGS, LIFELINE NETWORKS AND INFRASTRUCTURES SAFETY GAIN

SEPTEMBER 24, 2012

LISBON, PORTUGAL

SESSION SUMMARY

INTRODUCTION (*K. PITILAKIS*)

SYNER-G is a European collaborative research project focusing on systemic seismic vulnerability and risk analysis of buildings, transportation and utility networks and critical facilities. The originality of the project is the systemic approach of the vulnerability and risk assessment of complex interacting systems. The extreme disaster in Fukushima nuclear power stations in the 2011 Tohoku earthquake is a typical example of the importance of the systemic approach. The whole methodology is implemented in open source software tool and is validated in selected case studies. The research consortium relies on the active participation of twelve partners from Europe, one from USA and one from Japan. The consortium includes partners from the consulting and the insurance industry.

METHODOLOGY (*P. FRANCHIN, H. CROWLEY AND B. KHAZAI*)

SYNER-G developed an innovative methodological framework for the assessment of physical as well as socio-economic seismic vulnerability at the urban/regional level. The built environment is modelled according to a detailed taxonomy into its component systems, grouped into the following categories: buildings, transportation and utility networks, and critical facilities. The framework encompasses in an integrated fashion all aspects in the chain that goes from the regional hazard to fragility assessment of components to the social impacts of an earthquake, accounting for all relevant uncertainties within an efficient quantitative simulation scheme, and modelling interactions between the multiple component systems in the taxonomy. The socio-economic modelling approach is based on multi-criteria decision support, which integrates social vulnerability into the physical systems modelling approaches to provide decision makers with a dynamic platform to capture post-disaster emergency shelter demand and health impact decisions.

CASE STUDIES (*K. PITILAKIS, H. WENZEL, I. IERVOLINO AND P. FRANCHIN*)

The methods and tools developed in SYNER-G are tested and validated in appropriately selected and well constrained test sites of different scale, typological characteristics and seismicity. These include: **the urban areas of Thessaloniki (Greece) and Vienna (Austria), the harbour of Thessaloniki, the gas network of L'Aquila (Italy), a regional transportation and electric power network as well as a hospital facility in South Italy**. The overall performance and losses of each system or system of systems is estimated based on the proposed models of hazard and vulnerability analysis, considering the interactions and socioeconomic aspects. As an example, the expected number of displaced population and casualties is evaluated in the urban areas, the accessibility to critical facilities is estimated considering the road blockages due to building collapses or bridge and other infrastructure damages and the water network performance is calculated considering the pipeline breaks and the electric power shortages. The simulations are executed based on software tools that have been developed within the project.

SYNER-G CONSORTIUM

Aristotle University of Thessaloniki (coordinator)

Vienna Consulting Engineers

Bureau de Recherches Geologiques et Minieres

Commission of the EC - Joint Research Centre

Norwegian Geotechnical Institute

University of Pavia

University of Roma "La Sapienza"

Middle East Technical University

AMRA, Analysis and Monitoring of Environmental Risks

University of Karlsruhe

University of Patras

Willis Group Holdings

Mid-America Earthquake Center, University of Illinois

Kobe University

HTTP://WWW.SYNER-G.EU/