NEWSLETTER

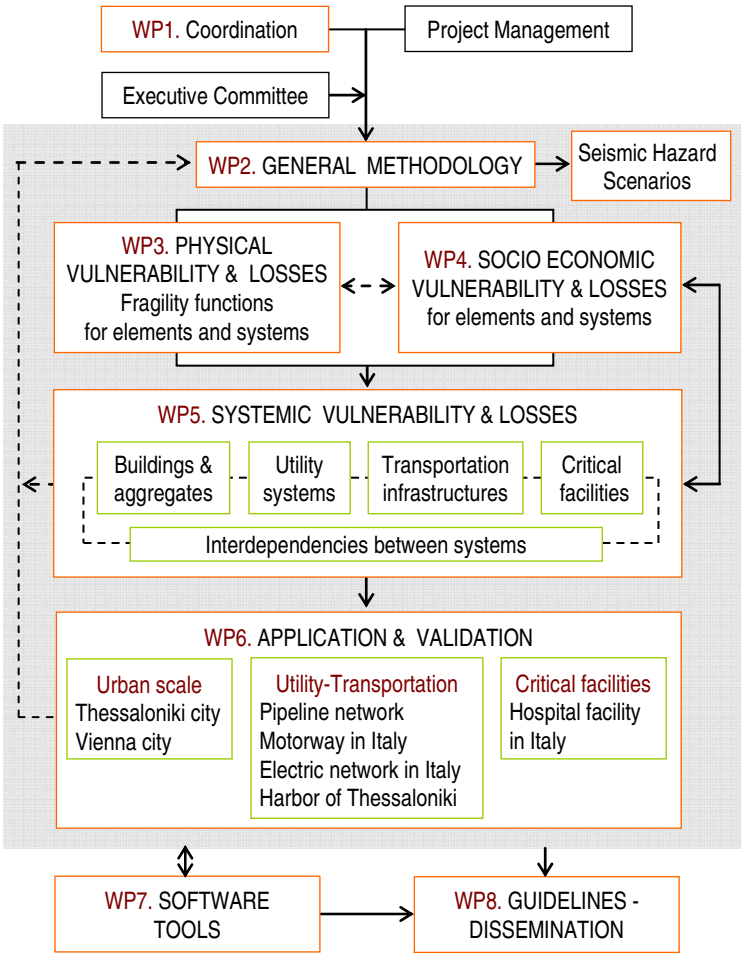
"Systemic seismic vulnerability and risk analysis for buildings, lifeline networks and infrastructures safety gain"

Issue 2, February 2011

SYNER-G is a European Collaborative Research Project focusing on the systemic seismic vulnerability and risk analysis of buildings, lifelines and infrastructures. The research consortium relies on the active participation of twelve partners from Europe, one from USA and one from Japan. The consortium includes a partner from the industry (VCE) and one from the insurance (Willis) area.

Project Workflow

SYNER-G is designed with eight work packages:



Information about the progress of WPs 2, 3, 4, 5, 6 is given in the following.

The 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, University of Naples Federico II
University of Karlsruhe
University of Patras
Willis Group Holdings
Mid-America Earthquake Center, University of Illinois
Kobe University

Recent News

- The new web portal has been set up: http://www.syner-g.eu/
- SYNER-G has been presented during the 5th International Conference on Recent Advances in Geotechnical Earthquake Engineering and Soil Dynamics @ San Diego, CA, 24-29 May 2010 and the 5th International Conference of Earthquake Geotechnical Engineering @ Santiago, Chile, 10 - 13 January 2011

General Assembly Meetings

The following meetings were held in 2010:

- Plenary meeting @ Rome on 18-19 March
- WP4 kick-off meeting @ Karlsruhe on 17-18 June
- 1st Annual meeting @ Vienna on 16-17 September with the participation of the International Advisory Committee (Prof. D. Giardini, Prof. M. Dolce)

Upcoming: Mid-term Meeting @ Oslo on 28-29 April 2011

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SEVENTH FRAMEWORK PROGRAMME

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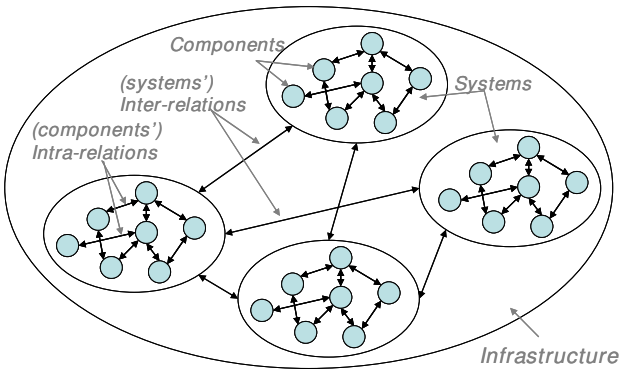
WP2: Development of a methodology to evaluate systemic vulnerability

- A general methodological framework to assess vulnerability at a system level considering interdependencies between elements at risk (physical and non-physical), belonging to different systems and between different systems as a whole, at city and regional scale, has been defined.
- A consensus taxonomy of the systems (i.e. the detailed list of all components making up the systems) to be dealt within SYNER-G was prepared, together with the description of ontology (i.e. the internal logic and functioning of the components and systems) and the establishment of a consensus terminology.

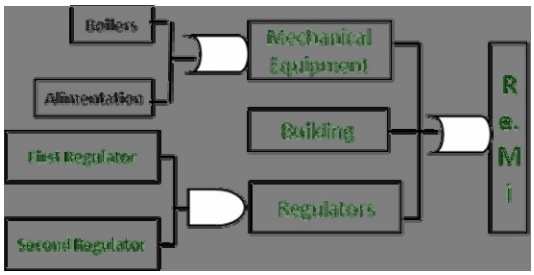


Abstract representation of the Infrastructure

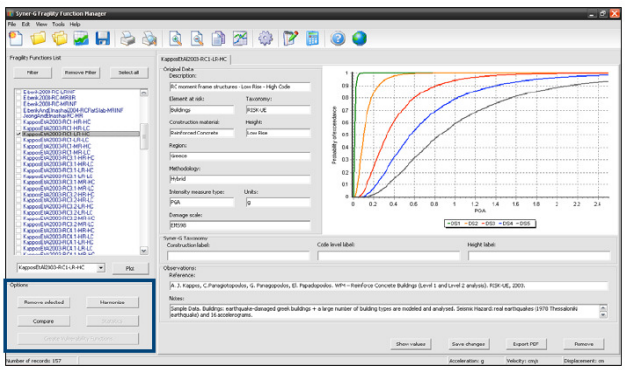
- An object-oriented framework for the simulation of an infrastructure in a seismic environment and the implementation of a prototype infrastructure for testing the framework has been set up.
- A conceptual framework for the selection of optimal Intensity Measure (IM) for the analysis of lifelines was prepared, together with the framework and criteria of seismic inputs and scenarios, adequate to every system vulnerability analysis.

WP3: Fragility functions of elements at risk

- Fragility curves have been proposed for all the systems' elements and will be finalized soon, based on the taxonomy/typology of WP2 framework. The fragility functions are based on methods and results that are available in literature and past projects, which have been collected and reviewed. In some cases the selection of the fragility functions is based on validation studies using damage data from past and recent earthquakes mainly in Europe. Appropriate adaptations and modifications have been made to the selected fragility functions in order to satisfy the distinctive features of the present taxonomy.
- In case of buildings, focus is given in compiling, harmonising and archiving (in a query-able database) the existing fragility functions that have been developed for European buildings.
- In other cases (e.g. bridges, embankments) new fragility curves are being developed based on numerical approaches. For certain elements (e.g. compression gas stations) fragility curves have been proposed based on fault tree analysis. Validation of proposed fragility functions using data from L'Aquila earthquake will be performed.



Fault-tree analysis of a Re.Mi gas cabin (L'Aquila) (Esposito et al. 2011)



SYNER-G fragility function manager tool (developed by UPAV)

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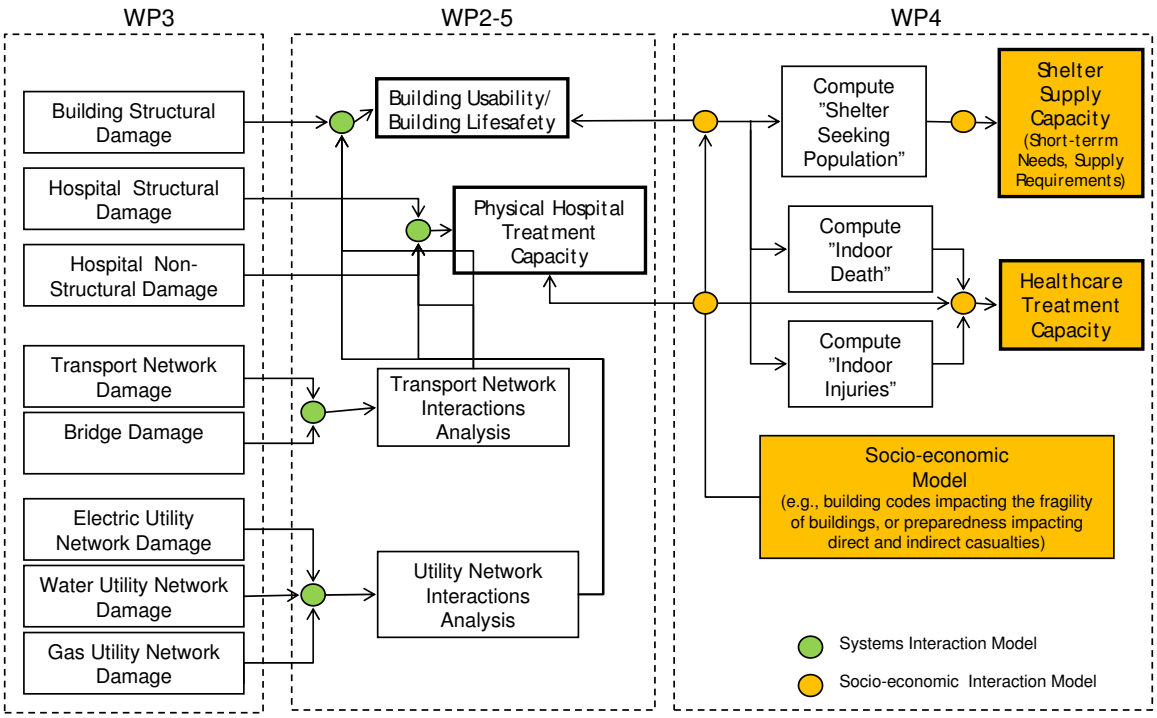
WP4: Socio-economic vulnerability and losses

- The sectors for the assessment of socio-economic impacts in the context of short-term emergency relief and recovery (2-3 weeks) were defined, along with the features for the development of the socio-economic framework. Temporary shelter and healthcare capacity are considered as the main sectors; transportation accessibility mode and utility serviceability model come to give inputs to the former and complete the framework.
- The interaction of socio-economic models with physical vulnerability/ loss estimation models will be included in the framework of a comprehensive methodology. Socio-economic and structural factors will be used for the definition of output indicator values for all sectors criteria.
- The benchmarking of socio-economic indicators will be based on the L'Aquila case study based on data that will be provided by the Italian Civil Protection.



Socio-economic Framework Development

WP5: Systemic vulnerability specification

The activities performed within WP5 are in parallel and in very close collaboration with WP2. The parameters governing the general methodology presented in WP2 are specified for each system in terms of performance measures. Performance(s) (physical vulnerability, serviceability/ functionality) definition at the components, systems and system of systems levels has been performed and is linked with WP4 work. The definition of performances for systems and for system of systems will be the key points of WP5 outputs. The main objectives of WP5, having as a starting point the simulation framework from WP2, have been identified, while the need to establish an interface with socio-economic consequence models was highlighted. For the specific types of systems examined (buildings, utility networks, transportation infrastructures, critical facilities), desired inputs, specificities of analysis, following developments to be made and interactions with other WPs and tasks are identified.

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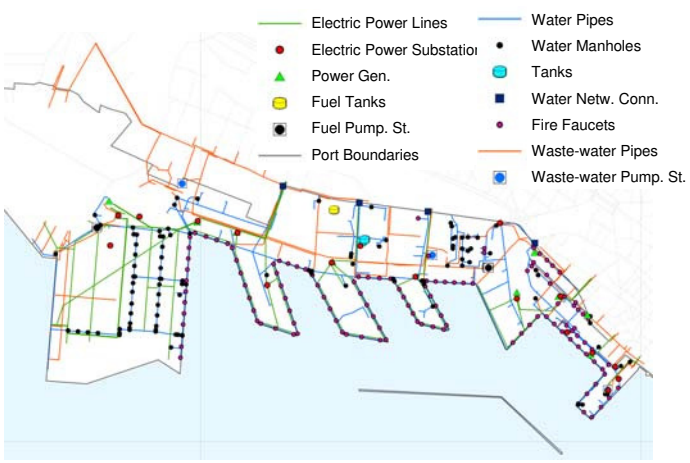
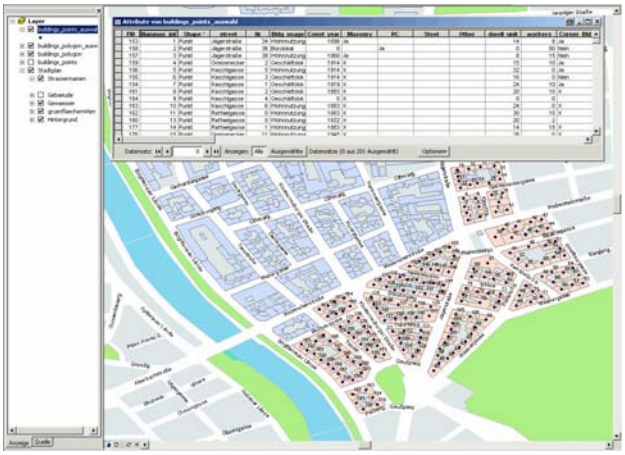
WP6: Validation studies

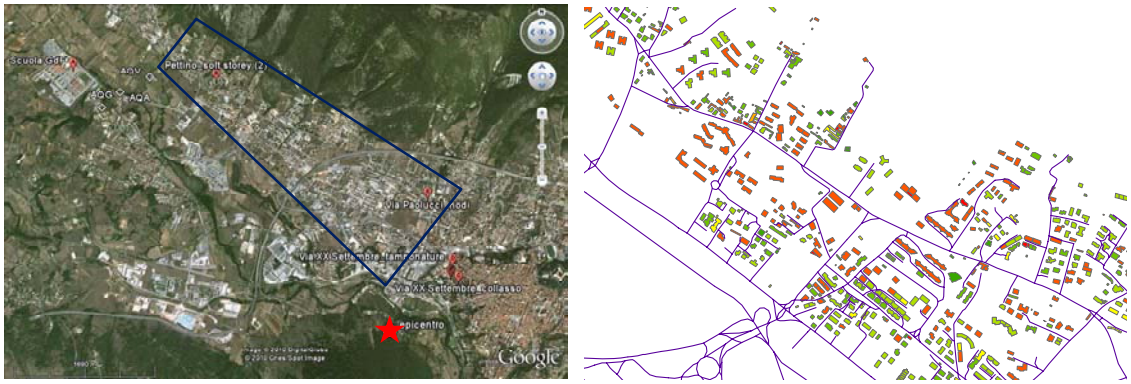
- The test area for Vienna will be the 20th district. A detailed identification of each building within the study area is under development, together with measurements of building eigen-frequencies.
- For the city of Thessaloniki a detailed database for buildings, lifelines, infrastructure and urban indicators is available and a comprehensive seismic hazard study has been performed in the recent past period. The update or validation of existing information will be performed based on the satellite images that will be acquired and the information from the "Urban Audit" database (EUROSTAT) in correlation to WP2 and WP4. The present seismic hazard and site effect data will be updated applying the methodology for seismic input to be developed in SYNER-G.
- L'Aquila constitutes the case study for the fragility and network analysis of gas system and benchmarking socio-economic indicators based on the experience of the recent earthquake (WP4). The gas system database is completed, while the hazard and fragility analysis is in progress. The incorporation of damage and repair data will be examined based on the available resources. The collection of information about shelters, possibly debris, emergency actions and availability of utilities after the L'Aquila earthquake has been started, in cooperation with the Italian Civil Protection.



Thessaloniki case study: Harbor database



Vienna case study: buildings database



L'Aquila case study: building benchmarking-Pettino area

SYNER-G is supported by EC/DG Research (Grant agreement no: 244061)
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