

Seismic risk assessment and mitigation in the Antakya-Maras region (Southern Turkey) on the basis of microzonation, vulnerability and preparedness studies (SERAMAR)

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1 Background and motivation

In recent years devastating earthquake disasters in Turkey lead to thousands of casualties and billions of economic loss. Not only the helplessness of local authorities and the circumstance of being not prepared in the immediate aftermath, but also the nonexistence of master plans able to minimize the primary and secondary effects of the natural disaster especially for the rural areas lead to the motivation of the project SERAMAR (Earthquake Damage Analysis Center 2004).

Even though most of the harm and damage to be caused by these earthquake disasters in Turkey occurred in small to middle-sized towns, more or less all international discussions and attempts concerning seismic risk assessment, mitigation, and early warning measures are mainly directed to the Marmara region around the mega city Istanbul.

The objective of this proposed study is to utilize current tools for earthquake risk mitigation within an environment where research entities from the European Research Area, local universities in Turkey and professional associations as well as local governments are enable to establish a unique partnership that would serve as a model for similar future endeavors.

2 Selected case study: Antakya/Hatay

The ancient city of Antakya lies in the southernmost tip of Turkey, and is currently built on an alluvial plain through which the river Asi flows. As with many other urban settlements in Turkey it has experienced a rapid expansion during the last several decades, even though being located in one of the most seismic endangered zones of Turkey.

With regard to the ancient history of the city Antakya and its large number of historical buildings the proposed project on seismic risk assessment and mitigation may also serve for the protection and preventive conservation of cultural heritage.

Judging by historical precedence, major earthquakes on this branch of the Dead Sea-East Anatolian fault system establish a real potential for occurrence in the city. Although major events are missing during the last 20 years, an earthquake of magnitude Mw 5.8 occurred in Antakya on January 22, 1997 producing moderate structural damages.

3 Tasks and objectives

The processing of the project SERAMAR is based upon a multi-disciplinary approach, bringing together the scientific fields of structural (earthquake) engineering, engineering seismology, risk assessment, and sociology.

Within the different project phases the region's specific earthquake hazard, the vulnerability of the city's building stock and lifelines based on the European Macroseismic Scale EMS-98 (Grünthal (ed.) *et al.* 1998), and the social vulnerability and societal vigorousnesses to earthquake disasters at different levels of society are identified and elaborated. Moreover, the society's state of preparedness, its risk awareness, and possibly existing early warning systems are analyzed by interviews and questionnaires.

In order to achieve these aims, certain tasks have to be realized by the different project working groups. Tasks and activities of the engineering group, which is lead by Earthquake Damage Analysis Center (EDAC) of Bauhaus-University Weimar are:

- detailed inventory of the current (undamaged) building stock by on-site inspection
- engineering investigation of structural damage being caused by future earthquake events
- sophisticated inventory of "high-priority" buildings
- instrumental geotechnical measurements
- instrumental vulnerability studies on selected building structures
- seismic risk assessment studies on the basis of different earthquake scenarios likely to occur in the respective region
- identification/tagging of endangered settlement areas
- elaboration of strengthening and retrofitting measures
- provision of strengthening recommendations and strategies for public institutions, building owners, and local construction companies
- training of university staff, construction engineers, and control institutions
- elaboration of prevention and preparedness strategies (regarding self- and outside help measures, healthcare system, insurance policy).

In addition, the sociological group (ISOKIA Kiel) is responsible for the following activities:

- performance of interviews with inhabitants to gather insights into the social structure, vulnerability structure, educational situation, and level of preparedness and risk awareness (Geenen 2004) in different groups of population

- comparison of the vulnerability level of the building structures with the social vulnerability of inhabitants in several aspects
- interviewing representatives and staff at different governmental and organizational levels and private enterprises concerning the state of vulnerability, preparedness, mitigation, resilience, and early warning in order to identify a differentiated view on social vulnerability and societal vigorousnesses to earthquake disasters at different levels of society, the society's state of preparedness, risk awareness, and early warning systems.

4 Results

The still continuing investigations of the interdisciplinary project are intended to lead to the following outcomes:

- Definition and description of aims to be reached on several societal levels by developing a master plan, naming and describing of steps together with the regional governments and involved organizations of the target regions.
- Monitoring and evaluation if the steps are reached within the described time schedule. Criteria and indicators for a sustainable development will be defined. Identification of preparedness, mitigation and early warning gaps and consulting of local governments in reducing these gaps.
- Joint development of an information program to promote knowledge and enhance preparedness.
- Initiation of consultation offices for the public on how to protect against earthquake hazards.
- Promoting of knowledge about warning, evaluation whether warning messages are well understood and how they should be changed (Geenen 1995).
- Workshops with participants of the region (including inhabitants) and external participants.
- Developing of a compressed manual. The comprehensibility will be tested and developed in collaboration with organizations active in disaster prevention, disaster management, and early warning.

References

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