STRATEGIES FOR THE VULNERABILITY ASSESSMENT OF LARGE BUILDING STOCKS

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The description of building vulnerability and resultant derived damage prognoses for different impact levels are the key element for any seismic risk study (see Figure 1). In cases where realistic, detailed and reliable risk scenarios should support socioeconomic decisions and mitigation strategies, the entire building stock must be considered, and a broad database is needed to allocate empirical vulnerability and/ or analytical fragility functions for the damage assessment. The engineer-assigned (most probable) vulnerability, performance score or building type specific fragility function have to consider the uncertainty in building response characteristic and the particularities of the local construction practice.

As an outcome of a Turkish-German joint research project on *Seismic Risk Assessment and Mitigation in the Antakya-Maraş-Region (SERAMAR)* different methods and strategies for the vulnerability assessment of a large building stock could be developed, applied and finally compared.

At the beginning of the SERAMAR project, all project partners agreed and decided to carry out a complete building stock survey despite the fact of the high effort, because any systematic elaboration of a *building typology for risk assessment* starts and fails with the level and quality of the building survey. In general, statistical data being relevant for an engineering evaluation of the buildings vulnerability are not available. In some cases, information about the age (construction period), the number of stories or – if the archives offer such documentation – undertaken rehabilitation measures can be derived and transformed into GIS-layers (GIS-Geographical Information System).

The whole building stock is classified on the basis of different parameters relevant to the seismic performance of the predominant construction types. In addition to the common classification of the building types, further criteria are investigated in order to conduct a more detailed vulnerability assessment with regard to the different approaches. This concerns e.g. criteria of layout irregularity as well as structural peculiarities, which could yield to special damage patterns. The location of these sub-classes are mapped using a GIS-tool together with the elaborated hazard parameters and risk data layers [Abrahamczyk *et al*., 2013].

The distinction of the building stock into building types is emphasized as an essential step before the suitable fragility function of for the risk study can be selected. The comparison of available fragility functions shows the demand on vulnerability (fragility) functions which appropriately represent the behavior of the building types being representative for the target area [Abrahamczyk et al., 2012].

The definition of building types requires the abstraction and reduction of the building characteristics (which is often hidden by the externally appearance) to the basic structural system and the failure and damage-determining criteria under seismic impact. The defined building types have to differentiate the preliminary assigned vulnerability classes of the existing buildings and to anticipate comparable damage pattern under comparable seismic impact.

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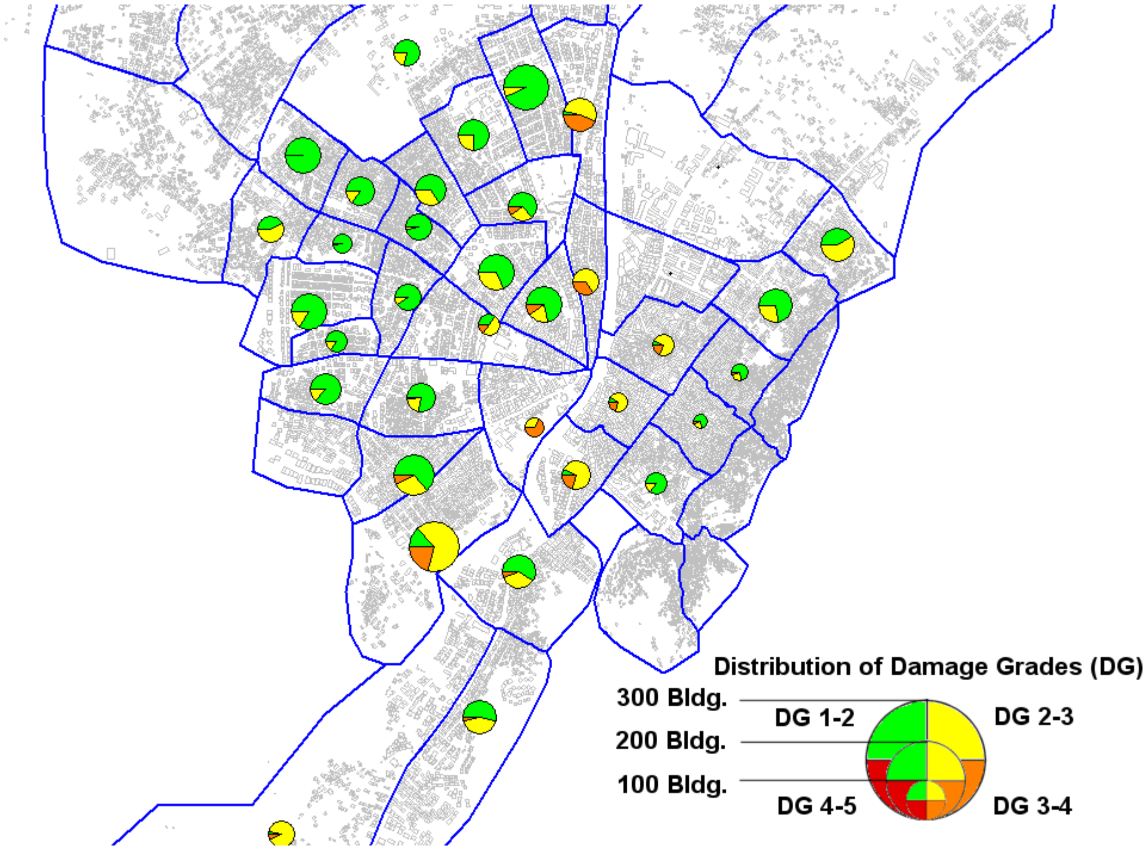

Figure 1. Example of a possible risk scenario for the City Antakya, Turkey

In this paper the derived building typologies for reinforced concrete structures as well as masonry buildings to the building stock of the study area Antakya will be presented; Similarities and differences of the building type depending typologies are discussed. Results of the empirical, analytical and hybrid vulnerability assessment methods will be compared and existing drawbacks identified as well as evaluated. Not at least, the outcome of instrumental testing and building monitoring is reviewed concerning the refinement and scaling of analytically derived fragility functions [Abrahamczyk & Schwarz, 2014].

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