



Seismic Hazard Assessment and Numerical Modeling for Seismic Microzonation purpose of Dushanbe, Tajikistan

Farkhod Hakimov^{1,2,3}, Hans-Balder Havenith², Anatoly Ischuk³, Marco Pilz⁴, and Klaus Reicherter¹

¹Neotectonics and Natural Hazards, RWTH Aachen University, Germany (f.hakimov@nug.rwth-aachen.de)

²Department of Geology, University of Liege, Belgium

³Institute of Geology Earthquake Engineering and Seismology, Dushanbe, Tajikistan

⁴Helmholtz Center Potsdam – German Research Center for Geosciences, Potsdam, Germany

Seismic hazard assessment of urban areas is an important and extremely challenging task. It is so important because without the knowledge of the influence of local soil conditions and properties, of the changing layer thickness in urban areas, and without considering multiple possible scenario earthquakes for this territory, engineers do not have enough information on how to design and construct seismically safe buildings. The particular challenge of this task is due to the great uncertainty affecting the prediction of the spatially (and sometimes even temporally) changing seismic properties of soils with respect to urban development.

Dushanbe is the capital of Tajikistan, a mountainous country marked by high to very high seismic hazard. The reason for the high seismic hazard specifically near Dushanbe is related to its location between two fault systems: South Gissar fault and Ilek-Vaksh fault. Estimation of the seismic hazard of the urban areas in Tajikistan is very important because they had developed in a very short time and many high buildings are being constructed now Existing seismic action estimations are based on the old approaches when the main factors of the local soil conditions only consider general engineering-geological features of the territory as well as macro-seismic observations data. An additional problem is the building code in Tajikistan; it uses the estimation of the ground motions in terms of the MSK-64 scale, but does not enough take into account the variety of the soil conditions in the Dushanbe city area. Existing seismic hazard estimation of the area of Tajikistan is based on the so-called “The map of general seismic zoning of the territory of Tajikistan”, that was produced in 1978 in terms of MSK-64 scale. The seismic microzonation map of the Dushanbe city area was made in 1975 in terms of MSK-64 scale as well and was based on the engineering-geological approach mostly. This map does not represent the highly variable soil conditions of the Dushanbe city area which are partly due to the anthropogenic influence of the large city. Therefore, earlier seismic zonation maps assigned an intensity of IX to most districts of the city. However, those previous studies did not sufficiently quantify the local effects of soils on the seismic hazard, mainly the macro-seismic conditions (the relative distance of districts to fault lines) were considered for the zonation.

This study describes and implements a number of new approaches to the evaluation of maximum seismic impact and site effect values.

