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Liquefaction probability in Bucharest and influencing factors

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More and more importance is accorded in the last years to the geo-risk assessment of soil liquefaction phenomena in regions hit relative often by strong earthquakes. The liquefaction is a very complex phenomenon, which can be initiated by strong earthquakes in sandy soils under different geological and hydrogeological conditions. The main geotechnical parameters, which permit to define the liquefaction potential of sandy layers, but especially the importance of hydrogeological conditions for occurrence of liquefaction are presented. The triggering mechanism of liquefaction due to earthquakes (pore water pressure excess), is also studied by pore water pressure records during earthquakes in liquefaction-susceptible soil layers. For the study of the occurrence of liquefaction phenomena, an interdisciplinary cooperation between geotechnical, geological, hydrogeological and seismological knowledge is needed. This cooperation was made possible within the frame of the Collaborative Research Center (CRC) 461: “Strong Earthquakes: A Challenge for Geosciences and Civil Engineering”, by the University of Karlsruhe, Germany, together with the Romanian Group of Strong Vrancea Earthquakes and is funded by the German Research Foundation (Deutsche Forschungsgemeinschaft). Favorable field conditions to study the complex phenomenon of liquefaction and its triggering mechanism at earthquakes are offered in Bucharest, Romania. Bucharest, situated on thick Quaternary soft soil deposits having about 100-300 m thickness with three main porous aquifers among them, is hit frequently by strong earthquakes occurring in the well-known *Vrancea*-seismogenic-zone.

Continuous groundwater level observations of the shallow aquifers in Bucharest dur-

ing the last 35 years are available and actual simultaneous groundwater level measurements in numerous hydrogeological boreholes in Bucharest were performed. In-situ records of pore-water-pressure and earth-pressure within shallow sandy-gravely layers permit to better-understand the mechanism of liquefaction initiation (triggering) during Vrancea earthquakes. The correlation between duration, magnitude and frequency content of the Vrancea earthquakes and the pore-water-pressure increasing, will offer new insights in this direction under the local geologic and hydrogeologic conditions of Bucharest. Recent Seismic Cone Penetration Tests with continuous pore water pressure measurements (SCPTU) targeted at several sites in Bucharest, brought additional useful data for the evaluation of the liquefaction probability in Bucharest. The cyclic resistance ratio (CRR), using quantities deduced by SCPTU is calculated by suitable empirical equations. Reported to the cyclic stress ratio (CRR), depending on the total and effective stress, the maximum acceleration and the magnitude of the earthquake, the factor of safety against liquefaction and finally the probability of liquefaction at different sites within the city are deduced.