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Assessment of Liquefaction Susceptibility of Kutahya Soils Based on Recent Earthquakes in Turkey

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The plate tectonic setting of Turkey resulted many destructive earthquakes having magnitude higher than 7 in several cities situated close to faulting system. The city of Kutahya and its surrounding counties are notable examples to be located in the earthquake prone region and therefore, several earthquakes have been recently recorded particularly in its Simav district. A significant part of the residential area of Kutahya is found on alluvial deposits dominated by silt and fine sand size materials, and its southern boundary is controlled by Kutahya fault zone (KFZ) extending parallel to the city settlement. In this study, considering the possibility of a potential destructive earthquake in future as well as increasing population dependent further demand for new building in this city, investigation liquefaction potential of these soils is aimed for using in earthquake risk mitigation strategies. For this purpose, physical, ground water condition and standard penetration test (SPT) results from 283 different boreholes spreading over a wide area were examined to understand the behaviour this soil under earthquake induced dynamic loading. The total assessed drilling depth is about 2140 m. Required corrections were applied to all SPT data for obtaining SPT-(N1)60 values for liquefaction analyses. The estimation representative magnitude, depth of epicentre and maximum ground acceleration (amax) based on previous earthquakes and faulting characteristics of KFZ were initial targets for accurately assessment liquefaction phenomena of this city. For determination of amax in this region, in addition to attenuation relationship based on Turkish strong ground motion data, individual measurements from earthquakes stations closing to study site were also collected. As a result of all analyses and reviewing previous earthquakes records in this region, earthquake magnitudes vary between 5.0 and 7.4, and amax values changing between 400 and 800 gal were used in liquefaction analyses and in liquefaction hazard maps. Considering the variation physical properties, particularly relative density and grain size of soil with depth, these maps were prepared for the depth of 1.5 m, 3.0 m, 4.5 m, 6.0 m, 7.5 m and 9.0 m. In addition, three different maps were designed based on the concept of liquefaction index for M-amax data pairs of 6.5- 400 gal, 7.2-400 gal and 7.2-800 gal, respectively. It may be concluded that these maps can be used better tools for the general public as well as land-use planners to provide more secure and planned urbanization in the city of Kutahya.