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Earthquake Hazard and Risk Assessment of Kutahya Settlement Area Founded on the Kutahya Fault Zone (KFZ)

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The city center of Kutahya and its surrounding settlements were built on unconsolidated debris materials and alluvial deposits, which mainly consist of silt and fine sand size soils. The southern part of this earthquake prone region is bounded by the Kutahya fault zone (KFZ) extending parallel to the city settlement, and so the entire buildings were founded on hanging wall block. Many destructive earthquakes such as the 1944 Gediz (M=6.2), 1956 Eskisehir (M=6.4), 1970 Gediz (M=7.2), 1970 Cavdarhisar (M=5.9), 2008 Simav (M=5) and recently the 2011 Simav (M=5.9) earthquakes were recorded on distinct fault zones around KFZ. On the other hand, no strong destructive earthquakes have been recorded during the period of instrumental recording in the close vicinity of Kutahya in conjunction with the KFZ. Such a longer time interval without strong seismic activity increases the importance of further research for understanding the physical properties and slip processes of the KFZ. By considering present-day situation of KFZ that is relatively quiet zone in a seismically active region one should expect accumulation of excessive elastic strain along the KFZ for very long time. Therefore, in this study, a comprehensive research program was performed to specify faulting characteristics of KFZ, determine physical and mechanical properties of related unconsolidated materials and finally evaluate the effect of earthquake hazard in this region. The KFZ was previously identified as right-lateral strike-slip fault formed with only one segment, however, during field investigation and measurements on fault planes to find representative strike, dip and net slip values, it was found that the KFZ might be classified as oblique strike fault. This active fault zone is about 40 km long and 3 km wide and consists of several segments having 5-10 km to 1-3 km long. While the rake angle measured from striations on this fault plane range between 58° and 80°, its representative strike and dip values is about N70°W/72°NE. Although the KFZ has not been the site of strong earthquakes until now, based on data provided by National Earthquake Monitoring Center, the earthquakes of micro scales consistently occurred in this region. Such seismic activity reveals building up more elastic strain and therefore the KFZ is likely to produce a subsequent earthquake of moderate or strong magnitude resulting irrepressible casualties and damage. Due to this potential earthquake hazard, detailed geological and geotechnical studies were carried out to predict soil behaviour under dynamic loading. Considering the rate of construction process of this city, the residential area of Kutahya was subdivided into three different zones, which are “areas suitable for settlement”, “areas requiring detailed geotechnical investigations” and “areas not suitable for settlement” with respect to available date and the distributions of the geological units. These seismic microzonations are thought to be useful for seismic risk analysis and mitigation strategy in the city of Kutahya.