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The evaluation and effects of creep behavior in an urban site located on talus slope, Turkey

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Soil creep, known as very slow downslope movement of soil mass, is controlled by two essential factors such as water content and daily cycles of freezing and thawing in the soil. Generally, it does not have dramatic effects in comparison with landslides; however, it may cause serious losses of infrastructures and superstructures if not considered. In this study, the vulnerability of downslope mass movement was investigated at one of the slope sites located in Gemlik district of Bursa city, Turkey. Three buildings were demolished in Manastir neighborhood site due to the problems i.e. tilting or rotating of structures caused by creep behavior of soil since 2004. The geological formation in this site is composed of talus which contains metamorphic limestone boulders mixed with sandy low plasticity clay matrix as a prevalent upper layer which is followed by highly and moderately weathered crushed schist layer with considerable clay content below. Since 2012 downslope movement of the soil has been monitored by the surficial geodetic observations to evaluate the creep behavior and estimate the related risk in the area. The data of the former geotechnical drillings were compiled and supplementary soil borings were conducted. Furthermore, within these boreholes, inclinometer casings were installed and subsurface movements and deformations of the sliding mass have been monitored since 2012. Laboratory experiments including index and residual shear strength tests were conducted on the soil samples recovered from different elevations of the layers at post drillings. The slope stability problem of the study site was analyzed by the limit equilibrium methods. The results of the back analysis and in-situ observations were compared and discussed. The overall results indicate that the slope movement is still active in the region which occupies a huge volume of moving mass that has a sliding surface at the depth of 14 meter below the ground surface. Although no groundwater was determined during the explorations, it was thought that seasonal wetting and drying cycles due to infiltration may initiate the creep behavior. Consequently, the preventive measures were discussed to decelerate the sliding movement that may extend the lifespan of the structures at the site for limited use of residence. We finally suggested that residence and resettlement provisions for this region shall be reconsidered during the preparation process of the next urban development plan.