Geophysical Research Abstracts
Vol. 12, EGU2010-7861, 2010
EGU General Assembly 2010
© Author(s) 2010

Experimental investigation of failure time prediction in landslides

Nejan Huvaj-Sarihan
Assistant Professor, Civil Engineering Department, Middle East Technical University, Ankara, Turkey (nejan@metu.edu.tr)

Many new landslides often originate in old landslide areas, on pre-existing slip surfaces at residual shear strength condition. Previous laboratory investigations of drained displacement rates with time for pre-sheared surfaces have been very limited. A detailed survey of the literature reveals that all of the laboratory constant load compression tests, and a significant number of slope movement records that have been interpreted, correspond to ground conditions in the range of fully softened to intact shear strength. In fact, a few researchers mentioned stress-controlled direct shear and ring shear devices; however, they didn't present detailed test results and interpretation. A new laboratory normal- and shear-load-controlled direct shear device was designed for observing the deformation-time behaviour of pre-sheared surfaces, under constant normal and shear load.

Estimating time to failure of a landslide based on measured creep movements have been suggested by various researchers. Some of the failure forecasting tools suggested in the literature are: relationship between minimum displacement rate before acceleration and time to failure; plot of inverse of velocity with time; and plot of acceleration with time.

Based on the laboratory creep deformation tests on pre-existing shear surfaces, it is observed that at any shear stress level, the logarithm of the displacement rate decreases linearly with increase in the logarithm of time (until it reaches a minimum rate and starts increasing). The slope of this relationship is more or less independent of the shear stress level. A plot of minimum displacement rate immediately before acceleration, and time to failure is presented together with Saito and Uezawa (1961) data. It is confirmed that the time to failure is inversely proportional to the minimum displacement rate preceding the acceleration to failure.

Inverse of velocity, and acceleration are also used as prediction tools, as was also used by other researchers. In the laboratory tests carried out in this study, a peak is observed in the inverse velocity-time plots (corresponding to the minimum displacement rate before acceleration), and then the inverse velocity values decrease toward zero (linearly or asymptotically) indicating the failure time. Acceleration and time to failure values are presented together with previous researchers' data from landslide case histories. Although the laboratory values of time to failure are very small (in the range of 1 to 100 minutes) and may seem to have limited use for real-life prediction, the lab test results confirm a linear trendline between acceleration and time to failure. This study is an attempt to investigate possible use of such forecasting tools. Although there are limitations in this laboratory study, the results show potential for forecasting tools to be useful with more data.