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Apparent steady-state friction coefficient of kaolin clay under different slip rates and drainage conditions

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Numerous researches have suggested that the slip rate of landslides affected the strength of slip zone significantly. Moreover, the excess pore pressure generating and dissipating during sliding controls the shear resistance of slip zone according to effective stress principal. This study aims at exploring the influence of slip rates and drainage conditions on the strength of kaolin clay. A low to high velocity rotary shear apparatus was used to measure the apparent friction coefficient of wet kaolin clay under a normal stress of 1 MPa and slip rate ranged from 10-7 to 1 m/s. The drainage conditions are controlled by alloy holders including radial, single and double drainage conditions. The experimental results show the “apparent” strength of submerged kaolinite clay (friction coefficient 0.1-0.5) is significantly lower than that of the dry one (friction coefficient 0.5-0.85). In general, the apparent strength of clay using relative impermeable holders (RD series) is somewhat lower than the one sandwiched by permeable holders (SD and DD series) when the shear velocity less than 10-4 m/s and equals to 1 m/s. The trend is opposite when the shear velocity is between 10-3 m/s to 10-1 m/s. The apparent steady state strength varied with shear velocity for RD series shows a similar trend of the results of dry one. The apparent steady state friction coefficients decreased slightly when the shear velocity increased from 10-7 m/s to 10-4 m/s. When the shear velocity larger than 10-3, the friction coefficients increases with increasing shear velocity and attend a peak value when the shear velocity equals to 10-2 m/s. After the peak, the apparent strength decreased rapidly. This decreasing trend is well correlated to the estimated temperature raise. Finally, the friction coefficient dropped rapidly (before slip displacements < 2 m) after first peak and increased again after the drop, which represents the excess pore pressure was induced and dissipated at the initial stage, especially in radial drainage condition (RD series). The results show the complexity of shear rate dependent strength of clay under different drainage conditions.