

Failure mechanism of the typical landslides in Jurassic red beds in the Three Gorges Reservoir, China

○Haibo MIAO, Kunlong YIN, Gonghui WANG, Toshitaka KAMAI

Landslides in the Jurassic red beds take up a great proportion of the landslides occurring in the Three Gorges Reservoir (TGR), China. The unique lithology and material composition gestate this kind of landslides and the particularity of the trigger factors like periodic rainfall and reservoir water level fluctuation determine the deformation-failure characteristics that are different from soil landslides and rock landslides. Sixty typical landslides in the Jurassic red beds in the TGR were selected as the statistical samples. The development laws of these landslides were obtained by analyzing the aspects of strata distribution, the material composition of the sliding body, and the thickness of the sliding body and sliding zone, as well as the rock mass structure. The results show that the landslides in the Jurassic red beds are mainly large scale landslides. They are most developed in the strata of J_2S and J_3p and are within the influence range of human engineering activities and reservoir water level fluctuation. Seven failure modes were summarized according to the rock mass structure and the deformation-failure external apparent. What's more, the monitoring data of accumulated displacement of the landslides selected and their deformation rate were analyzed deeply in combination with the trigger factors such as rainfall and fluctuation of reservoir water level. The results show that the curve of accumulated displacement with time has the trend of 'step by step'; meanwhile, the curve of displacement rate with time is periodic wavy (Fig. 1). As shown in Fig. 1, there are two processes in the pre-failure stage for this kind of landslides, one is the

shear process with different shear speed and the other is static stage in consolidation for strength recovery.

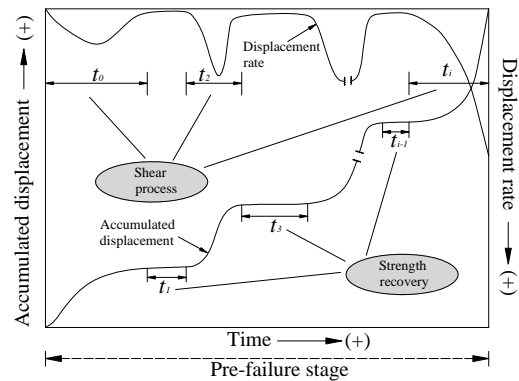


Fig. 1 Schematization of accumulated displacement and rate of landslides in the Jurassic red beds in the TGR

In order to understand the deformation-failure mechanism of the landslides in the Jurassic red beds in the TGR, the ring shear tests were performed with different shear speed and consolidation time on the sliding zone samples which were collected from two typical landslides. The results show that the sliding soil with high clay fraction has the positive speed effect. In addition, the strength recovery is more significant for the sliding soil with high clay fraction. The change of pore water pressure of the sliding soil, which responds to the fluctuation of groundwater level caused by rainfall and reservoir water level, is the trigger of the landsliding. With the increase of pore water pressure in sliding soil, the effective normal stress decrease which lowers the shear strength, and as a result the shear failure occurs. However, with the shearing continuing, the pore water dissipates gradually, and then the shear strength recovers enough to stop the shearing (sliding) consequently.