A shear strength model considering the influence of water content

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Seepage of slope caused by rainfall infiltration and reservoir level is one of the most common phenomenons in the slope destruction. It is claimed that the increase of the sliding force caused by increased soil weight and pore water pressure is the main reason which lead to the instability of the slop. Recently more and more researchers have noticed that the decrease of shear strength is essential to the slope disasters. The parameters of shear strength are crippled by growing water saturation as to give rise to the slop instability. From this point of view, a large number of researchers are engaged in the shear strength of unsaturated soil, the shear strength models are developed constantly. However, most of the traditional models are established the relationship between shear strength and matric suction. As the matric suction is difficult to measure, the traditional models cannot be widely used in engineering field. By establishing a model including water saturation directly, the shear strength can easily be predicted by engineers.

Based on above reasons, this article, which is based on formula of Bishop and the model of soil-water characteristic of Van Genuchten, establishing a multiple parameter model which is considered the water saturation directly. Afterwards, this paper takes red soil which comes from the Three Gorges Reservoir Region as the object, devising the triaxial shear test and soil water characteristic curve test as to acquire the red soil's shear strength model by the least square method. Next the rationality is verified and the reasons of error are analyzed. The results show that the predicted data coincide better with the experimental data and the model has predicted the shear strength of red soil preferably. Cohesion and internal friction angle decrease with the increase of water saturation. When the normal stress is constant, shear strength of red soil increases logarithmically with the increasing water saturation.

Overall, this work presents a modified shear strength model which considered water saturation. It is believed that the shear strength of the unsaturated soil could be predicted by the measurement of water saturation.