

**An Experimental Study  
of the  
Dynamic Behavior of Slickensided Surfaces**

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# **AN EXPERIMENTAL STUDY OF THE DYNAMIC BEHAVIOR OF SLICKENSIDED SURFACES**

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## **ABSTRACT**

When a clay soil is sheared, clay particles along the shear plane become aligned in the direction of shear, forming “slickensided” surfaces. Slickensided surfaces are often observed along the sliding plane in field landslides. Because the clay particles along a slickensided surface are already aligned in the direction of shear, the available shear resistance is significantly less than that of the surrounding soil.

During an earthquake, ground shaking often causes landslide movement. For existing landslides or repaired landslides that contain slickensided rupture surfaces, it is reasonable to expect that the movement will occur along the existing slickensided surfaces, because they are weaker than the surrounding soil. The amount of movement that occurs is controlled by the dynamic resistance that can be mobilized along the slickensided surfaces.

The objective of this study was to investigate, through laboratory strength tests and centrifuge model tests, the shearing resistance that can be mobilized on slickensided rupture surfaces in clay slopes during earthquakes. A method was developed for preparing slickensided rupture surfaces in the laboratory, and a series of ring shear tests, direct shear tests, and triaxial tests was conducted to study the static and cyclic shear resistance of slickensided surfaces. Two dynamic centrifuge tests were also performed to study the dynamic shear behavior of slickensided clay slopes. Newmark’s method was used to back-calculate cyclic strengths from the centrifuge data.

Test results show that the cyclic shear resistance that can be mobilized along slickensided surfaces is higher than the drained shear resistance that is applicable for static loading conditions. These results, coupled with a review of existing literature, provide

justification for using cyclic strengths that are at least 20% larger than the drained residual shear strength for analyses of seismic stability of slickensided clay slopes. This represents a departure from the current state of practice, which is to use the drained residual shear strength as a “first-order approximation of the residual strength friction angle under undrained and rapid loading conditions” (Blake et al., 2002).

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