RESEARCHERS SURVEY RATTLESNAKE RIDGE LANDSLIDE

Mar 15, 2018

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Above: Chris Robertson (left), Navid H. Jafari (center) and Timothy D. Stark observe tension cracks along the scarp and graben of the massive Rattlesnake Ridge Landslide near Yakima, Wash.

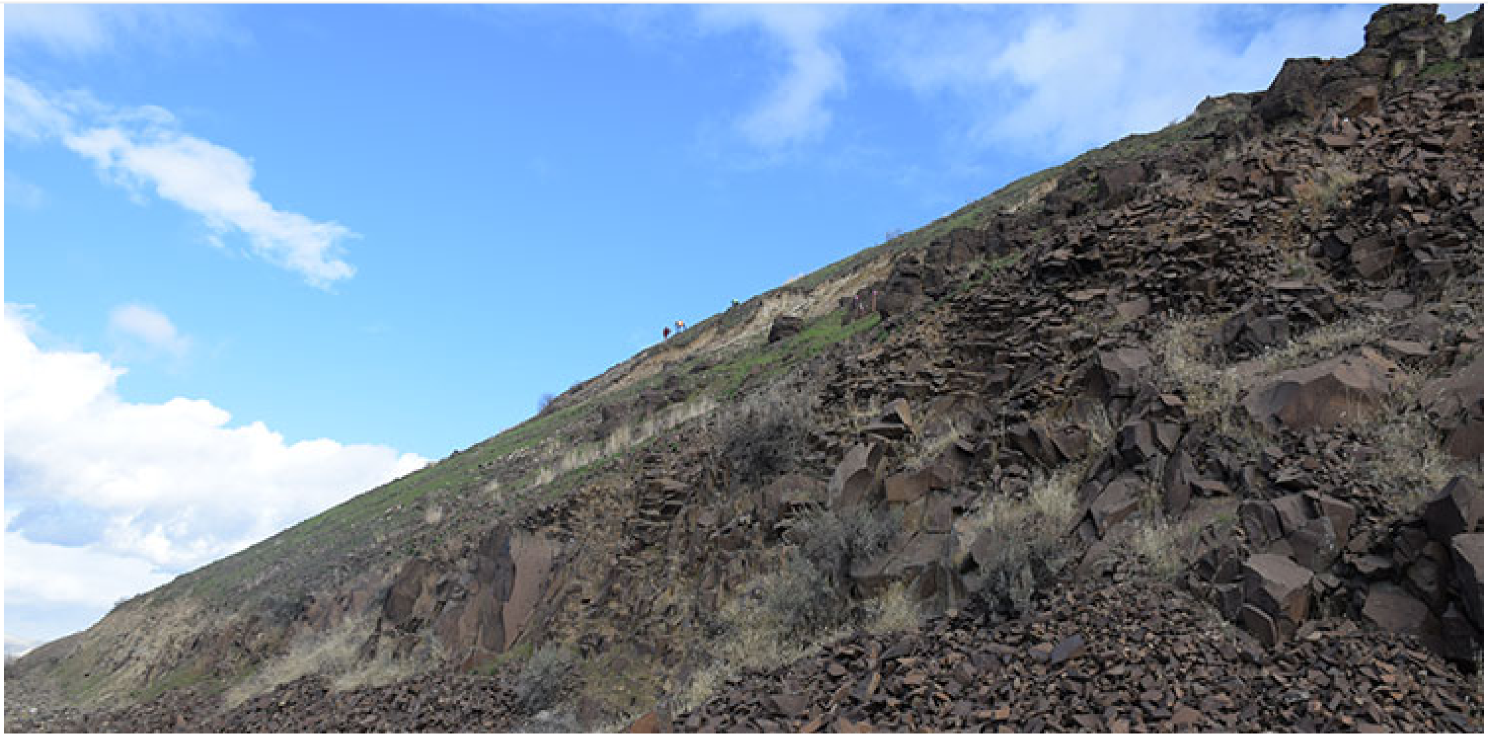
By Kristina Shidlauski

Professor Timothy D. Stark (/directory/profile/tstark) from the Department of Civil and Environmental Engineering (CEE) at the University of Illinois at Urbana-Champaign received a CEE-funded Rapid Response Grant to survey the massive Rattlesnake Ridge Landslide, located near Yakima, Wash. From February 15-18, 2018, Stark joined a team of researchers from the American Society of Civil Engineers' Geo-Institute to observe the slide first-hand, and collect field data and shear surface samples.

(/sites/default/files/RattlesnakeRidge_Fig01_crop.jpg) The cracks above the quarry equipment are clearly visible from a distance.

The landslide became apparent in October 2017 when cracks were noticed along the ridgeline, located above a nearby quarry. The slow-moving slide has an estimated volume in excess of 5.2 million cubic yards affecting 20 acres of the hillside. Measurements indicate that the slide has moved more than 25 feet since monitoring began and continues to move at a rate of approximately 1.7 feet per week, primarily towards the quarry.

"Some of the recent surveys suggest that the current rate of movement is accelerating, which made it important for the team to promptly visit the site to collect data and samples," Stark said.



Stark, barely visible in an orange safety vest, explores the steep slope consisting of old volcanic basalt flows.

The research team consisted of Stark; CEE alumnus Navid Jafari (MS 11, PhD 15), Assistant Professor at Louisiana State University; Daniel Pradel, Professor of Civil Engineering at The Ohio State University; and Chris Robertson, a Vice President with Shannon and Wilson Inc. in Seattle. The team surveyed much of the slope area, including the exposed scarp and volcanic geology, and noticed some interesting features. First, Stark said, while the main mass of the slide is moving primarily towards the quarry, a portion is moving to the natural slope toe. Additionally, the failure surface is complex and locally stepped, or changes geologic units.

“The stepped failure surface is unusual because typically the failure surface will follow a weak layer and then cuts steeply through the stronger overlying materials to reduce the shear resistance.” Stark said. “However, this shear surface jumped upslope until it located another weak layer and traversed the slope at a relatively flat angle until it cut upslope to the scarp.”

Stark said these features suggest that strong three-dimensional (3-D) effects are impacting the shape, direction and failure surface geometry of the landslide.

(/sites/default/files/RattlesnakeRidge_Fig04.jpg)
The complex failure surface extends upslope from the quarry in a fairly linear fashion, then abruptly turns upslope to another weak layer until it reaches the scarp at the top of the slope.

Stark plans to use the landslide as part of a research project on 3-D slope stability (https://www.nsf.gov/awardsearch/showAward?AWD_ID=1562010&HistoricalAwards=false) funded by the National Science Foundation. The collected samples will be tested to measure the fully softened and residual shear strengths for use in 2-D and 3-D slope stability analyses.

The CEE Rapid Response Grant program was developed to facilitate rapid-response, high-impact research related to infrastructure improvement and risk management in the aftermath of natural and man-made disasters. Previous grants have allowed CEE researchers to study the I-5 bridge collapse in Washington State, flood damage in Illinois, Missouri and Louisiana, and tornado damage in Oklahoma.

← Older (http://cee.illinois.edu/news/fazlur-khan-honored-sesquicentennial-composition)

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