



Contents lists available at ScienceDirect

# Journal of Rock Mechanics and Geotechnical Engineering

journal homepage: [www.rockgeotech.org](http://www.rockgeotech.org)

Full length article

## A case history study on causation of the landslide in Santa Clara, California, USA

Yun Liao<sup>a,\*</sup>, Sadek M. Derrega<sup>b</sup>, Craig A. Hall<sup>a</sup><sup>a</sup> Kleinfelder, 1330 Broadway, Suite 1200, Oakland, CA 94612, USA<sup>b</sup> Kleinfelder, 4670 Willow Road, Suite 100, Pleasanton, CA 94588, USA

### ARTICLE INFO

#### Article history:

Received 23 January 2015

Received in revised form

10 February 2015

Accepted 12 February 2015

Available online 12 March 2015

#### Keywords:

Pre-existing landslide

Failure mechanism

Slope stability

### ABSTRACT

This paper presents a case history study on the geologic investigation and numerical modeling of a reactivated landslide in the County of Santa Clara, California to identify the failure mechanism. The landslide occurred on an approximately 18.3-m high, north-facing slope during March 2011. The landslide measured about 33.5 m in width and about 51.8 m in length. Along the toe of the slope, a residential structure with a swimming pool was built on a cut and fill pad and there are several other structures present along the western side of the pad. The landslide occurred immediately to the south of the residential building and moved northward between the County Road A and the house's side yard. The movement of the landslide resulted in damaging the west-bound traffic lane of County Road A and encroached onto the paved driveway for the residential property. An investigation was performed to identify the failure mechanism of the landslide to conclude whether Road A re-alignment by the County or prominent cutting performed along the lower portion of the slope by the homeowner during 2000 through 2004 contributed to the reactivation of the old landslide deposit. The investigation included site reconnaissance, reviewing available published geologic information, reviewing site-specific geologic and geotechnical data developed by other consultants, and performing numerical modeling. The outcomes of the investigation indicate that the primary causation for the reactivation and failure of the subject pre-existing landslide is the prominent cutting performed along the lower portion of the slope during 2000 through 2004 and water tank cut bench. The Road A re-alignment did not contribute to the reactivation of the old landslide deposit.

© 2015 Institute of Rock and Soil Mechanics, Chinese Academy of Sciences. Production and hosting by Elsevier B.V. All rights reserved.

## 1. Introduction

The landslide is located within the County of Santa Clara in the San Francisco Bay Area, California, as shown in Fig. 1. The landslide occurred on an approximately 18.3-m high, north-facing slope that separates the east/west trending Country Road A to the south from the residential structure. Along the toe of the slope, the residential structure is built on a cut and fill pad and there are several other structures present along the western side of the pad including a detached storage shed, a pool house, several large planter boxes, a barbecue area, a swimming pool, a spa, concrete-filled solar array panels, and a concrete patio. A relatively steep and paved driveway provides access from Road A to the residential structure.

The landslide occurred immediately to the south of the residential structure and moved northward between Road A and the house's side yard. The landslide measured about 33.5 m in width and about 51.8 m in length. The slope area to the east of the landslide and upslope of the access driveway appeared to have been cut. The lowermost portion abutting the driveway has been cut and over-steepened. The cut slope portion at the northeast corner of the landslide and the driveway exceeds 9.1 m in vertical height with a steep gradient of 1 horizontal to 1 vertical (1H:1V) as shown in Fig. 2. A relatively narrow mid-slope cut bench with an associated 0.9- to 1.5-m high cut slope above the bench extends westward at near mid-height between the driveway and Road A until it merges with an approximately 6.1-m wide level bench cut across the landslide where the tank was situated. A circular water tank occupied the western part of the noted bench. This bench and the water tank were displaced downslope as the landslide moved northward. An approximately 3- to 3.7-m high cut slope, with slope gradients varying between about 0.5H:1V and 1H:1V, that was generated as a result of the water tank cut bench borders the bench along its upper (south) side.

\* Corresponding author. Tel.: +1 510 628 9000.

E-mail address: [jliao@kleinfelder.com](mailto:jliao@kleinfelder.com) (Y. Liao).

Peer review under responsibility of Institute of Rock and Soil Mechanics, Chinese Academy of Sciences.

1674-7755 © 2015 Institute of Rock and Soil Mechanics, Chinese Academy of Sciences. Production and hosting by Elsevier B.V. All rights reserved.

<http://dx.doi.org/10.1016/j.jrmge.2015.02.006>

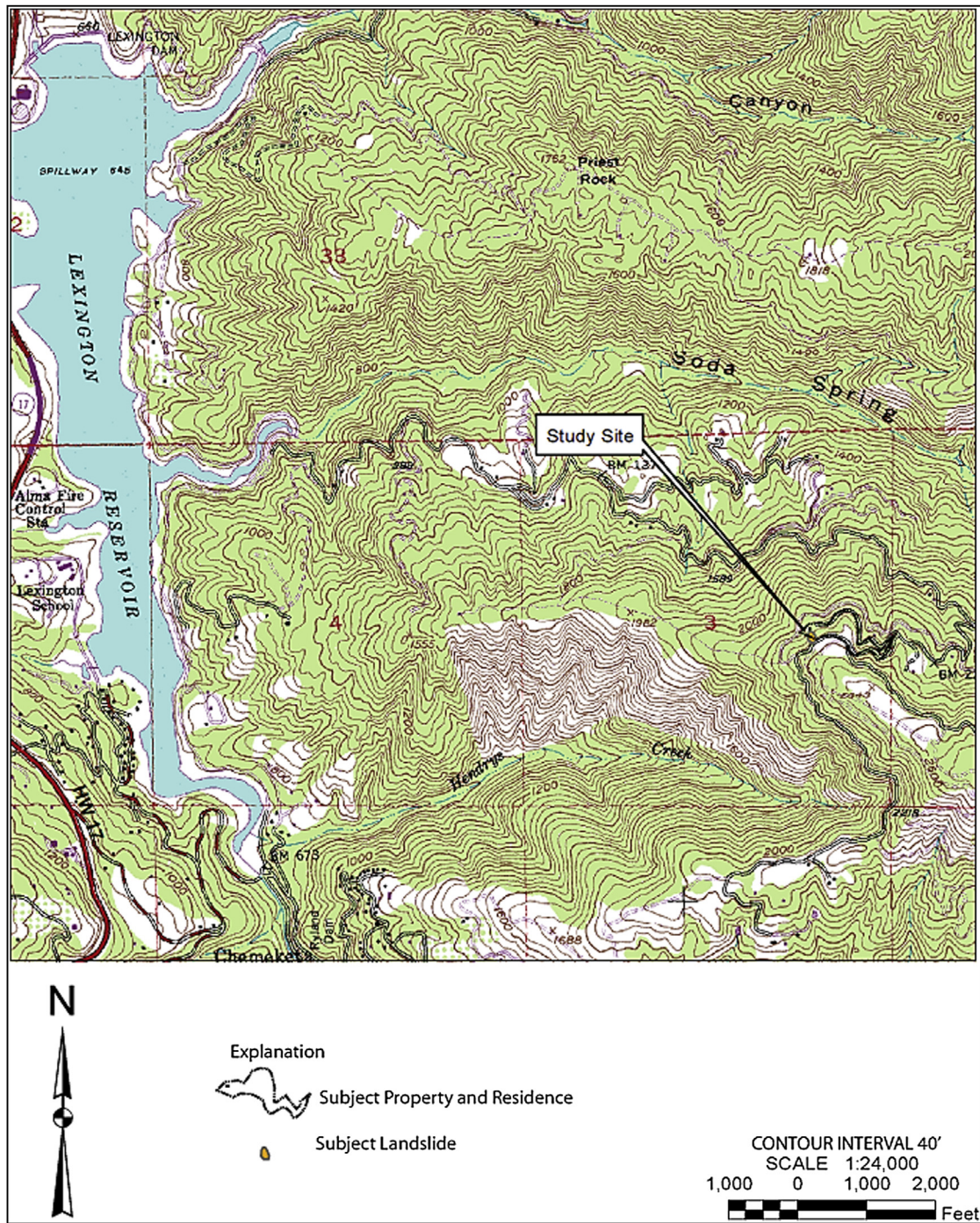


Fig. 1. Location of the 2011 landslide (After McLaughlin et al., 2001).

The topographic contours within the limits of the landslide as shown in Fig. 2 depict the topography of the body of the landslide in 2012 after the geomorphic expression of the slope failure had been altered by toe cuts, pioneered access routes for the subsurface exploration equipment in addition to activities related to the soil nail wall construction along the landslide’s headscarp. The surveyed topographic contours from the July 2011 topographic survey conducted by Westfall were superimposed to the area of the water tank and its cut bench. The survey was performed after the failure but before the subsurface exploration took place to show the extent and magnitude of cut associated with the water tank construction.

Although this noted level bench and associated cut slope had been displaced northward as the landslide moved downslope, their relative measurements and gradients remained largely intact.

Beyond the western landslide margin of the landslide to the west, the toe of the slope abutting the created level area where the sheds and planters are situated has been cut steeply to a near-vertical gradient that varied in vertical height from about 0.9 m to 2.4 m. A concrete stairway that was cut ascending the slope is present abutting the northwest corner of the landslide at the western landslide margin. Near mid-height of the slope to the west of the landslide, another cut bench that measured up to about 6.1 m

Download English Version:

<https://daneshyari.com/en/article/286686>

Download Persian Version:

<https://daneshyari.com/article/286686>

[Daneshyari.com](https://daneshyari.com)