Travis McStraw, John De Leon
CE EN 544 Project

The 2005 La Conchita Landslide

Overview

In 2005, the small town of La Conchita, California experienced a dangerous landslide event. Unfortunately, such an event has not been uncommon to the area in the last few hundred years. Since 1865, there have been five major landslides that have been recorded in the area. Although the slope failure was relatively small in comparison to previous landslides, several characteristics of its movement and its physical features made it more dangerous. The causes for the failure can largely be attributed to poor anthropogenic practices implemented in the area. A few slope stability failure models accurately simulated how the landslide occurred.

Physical Features of the Slope Failure

The bluff above La Conchita is 180 meters in height and is the result of tectonic uplift. Its current rate of uplift is 5 mm/year. The bluff above La Conchita consists of hardened marine sediment from the Monterey and Pico Formations. The slope is composed of interlayered siliceous shale, siltstone, sandstone, and mudstone. These geological formations are very weakly cemented and prone to mobilization. In addition to these conditions that are primed for movement, the active Red Mountain Fault extends across the face of the slope. The depth of the failure plane of the 2005 landslide was 15 m deep in the upper portions of the slope and decreased to about 6 m deep near the toe. It appeared that most of the material that was mobilized was dry and so it was assumed that the slope failure occurred along a deeper, more saturated and fluidized plane of material. Most of the material that flowed down the slope was dry and viscous, so instead of flowing around and into the houses at the base of the slope, the material pushed these houses off of their foundations, acting as battering ram.

Causes of the Slope Failure

In 2000, a retaining wall composed of wood and steel I-beams was built to open a street that had previously been buried underneath the toe of the 1995 landslide slope. Unfortunately, this wall did not provide adequate drainage. It created a barrier for groundwater flow, which increased the hydrostatic pressures at the toe of the 1995 landslide slope. Additionally, the 1995 landslide disrupted the drainage of Ranch Road, a road that previously traversed the landslide area perpendicularly about halfway up the bluff. All runoff southeast of the road drained into the 1995 landslide area and eventually stored enough water in a landslide-induced depression to form a pond called Anderson Lake. Nothing was done to prevent this unlined water channel to form in the middle of the 1995 landslide material. Eventually, a combination of poor drainage and two weeks of heavy rainfall in 2005 caused the soil to become saturated with water and mobilize into a landslide strong enough to breach the retaining wall. Figure X shows the areas affected after the 2005 landslide.

Slope Stability Analyses

There were a few slope stability analyses that were investigated to model the movement of the landslide and better understand its causes. Geologists and engineers calculated and measured initial parameters for the pre-2005 landslide slope and used them as input for a program called Fast Langrangian Analysis of Continua (FLAC), which calculated the location of the failure plane with the lowest factor of safety. Another program called FLO-2D was used to model the movement of the slope failure. Using initial parameters estimated by engineers, it predicted spatial and temporal values of flow depth and velocity for each grid cell of the model mesh to create a simulation of how the material moved during the slope failure. Hopefully the accuracy of these models can be improved by the simulation of the 2005 La Conchita landslide to better predict slope failures in the future.

Bibliography

Jibson, R. W. (2005). *"Landslide Hazards at La Conchita California."* United States Geological Survey

Pradel, D. (2014). "The Progressive Failure Reactivation of La Conchita Landslide in 2005." *Geo-Congress 2014 Technical Papers*, 3209-3222.

Shrestha, P. L., Shaller, P. J., Doroudian, M., Sykora, D. W., and Hamilton, D. L. (2011). "The 2005 La Conchita Landslide, Calfornia: Part 2 - Modeling." *Italian Jornal of Engineering Geology and Environment*, 751-758.