Vajont Dam Disaster

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During the night of October 9, 1963, the Vajont dam landslide occurred. 270 million cubic meters detached from Mt. Toc, crashing into the reservoir below up to speeds of 100 km per hour. This produced a tsunami wave 250 meters high, overtopping the dam and washing away 6 different villages below the dam. Over 2000 lives were lost.

In the location of the Vajont Valley, a 160 m tall dam was constructed in the jagged mountain side. Upon its completion the reservoir filled, in spite of some contrasting professional opinions to stop. Upon filling the reservoir, movement of land was observed. This massive landslide was monitored and discretely expected to happen. But the drive for the reservoir to be filled was too much, due to the high profits expected from the hydro-electric power received from the dam. But the cost, especially ethical cost, was high.

One possible cause of this landslide was the geologic formation of the Vajont Valley by Mt. Toc. Mt. Toc suffered from a prehistoric, ancient landslide. This landslide occurred in a highly plastic clay layer. This clay layer failure plane remained unhealed, making Mt. Toc highly unstable. In fact, Toc means ‘broken’ or ‘rotten.’ The sediments that gathered on top of the old failure plane and the potential of another massive landslide increased. This theory of prehistoric landslide was not widely accepted, and researchers argued that this was a new landslide. The answer to this remains open. Fundamental data and criteria remain unknown, especially after the 1963 slide occurred. Geometries, stratification, slopes of the prehistoric land, and rainfall or groundwater levels are unknown.

The more accepted causation of the landslide was the filling and rapid drawdown of the reservoir water elevation. In 1960, when the reservoir was raised to 630 m, a rapid increase of movement was shown, near 40 cm/day. It was assumed that the landslide rate could be managed with the reservoir elevation. In 1962, the reservoir was raised to an elevation of 695 m, and the movement increased only to 13 cm/day. The reservoir was filled again in 1963 to an elevation of 700 m, and the rate of movement increased dramatically, until the landslide started.

The failure surface was located in a thin layer of clay found in the limestone formation. Increasing the reservoir levels increased the pore pressures which led to lower effective stresses. The rapid drawdown of the water caused higher stresses along the failure plane. The failure was brittle, fast, and devastating.

A very basic slope stability analysis was performed on UTEXAS based on the known parameters and some soil assumptions. Two sections were analyzed, and while they both resulted in a factor of safety lower than 1 (failure), the lowest factor of safety was computed to be 0.588. From the UTEXAS models, the assumed failure plane, where the clay/limestone layer was, is where the models failed as well.

References

Criteria for rapid sliding I. A review of Vaiont case

Eduardo E. Alonso, , Núria M. Pinyol

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Italy's Forgotten Tragedy.

Periodical / Bassi, Daniele

2016, Geographical (Geographical Magazine Ltd.), volume 88, issue 3, starting on page 44, English

The prehistoric Vajont rockslide: An updated geological model

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