Failure Probability of Lushan Landslide, Taiwan

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The Lushan landslide located in the middle of Taiwan, has slid and damaged the road due to typhoons or heavy rainfalls for recent decades. It's seriously affecting the safety of life and property of the Lushan Hot Spring Tourist Area and local residents in the lower slope. In order to understand the probability of failure (Pf) of Lushan landslide, we built a numerical model by Plaxis2D, which is validated by the monitoring data of the 2009 typhoon Morakot. However, due to the lack of complete parameter data, uncertainties exist and may affect the simulation result of the collapse. With the back calculated friction angle ($\varnothing$) and cohesion (c) from Plaxis2D, we used the Monte Carlo Simulation (MCS) to consider the friction angle and the cohesion of sliding body as random variables with uncertainty. The results are statistically analyzed to obtain the Probability Density Function (PDF) of the two parameters. Based on the parameter settings above, with the designed rainfall events at 24hr, 48hr and 72hr rainfall duration and 10, 25, 50, 100 and 200 years of recurrence interval, we calculate the factor of safety (SF) of the Lushan landslide in these 18 simulated rainfall events. Finally, we can obtain the distribution of factor of safety (SF) and probability of failure (Pf) of the Lushan landslide in different rainfall durations and recurrence intervals.

Keywords: probability of failure, Monte Carlo Simulation, uncertainty