



Slope factor and shallow landslide occurrence

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Elevations in a mature mountain are generally normally distributed and slope gradients do. Shallow landslides occur on hill slopes and involve only regolith on the slopes. The slope gradient distribution of shallow landslides (including rock falls) is also a normal distribution; similar to that of natural slopes in shape, but shifting to a higher gradient. A probability of failure curve, which is defined as the ratio of landslide cells and total cells at each interval of a factor, then shows a shape close to a cumulative normal distribution and may be fitted with a Weibull curve. The probability of failure curve commonly shows an increase of failure from gradient about 0.5 to about 1.5, and then become saturated. There are few landslides located at slope less than about 26 degrees and lost its correlation with slope when slope greater than about 56 degrees, indicating landslide type change (rock falls). This is true for the storm-induced landslides.

As to the earthquake-induced landslides, there are differences to the storm-induced landslides both in distribution curve and probability of failure curve. Earthquake-induced landslides most occurred at slope gradient from 20 degrees to 54 degrees and shows a mode about 42 degrees, whereas storm-induced landslides most occurred at slope gradient from 20 degrees to 44 degrees and shows a mode about 33 degrees. There are fewer occurrences of rock falls in a storm event than that in an earthquake event. Also, earthquake-induced landslides do not show saturation at higher slope gradients in the probability of failure curve.

Normally distributed topographic pattern may skew in young mountains, like those in southern Taiwan or hilly terrain in western Taiwan, and the characteristic Weibull-shaped probability of failure curve may change also. It even becomes not applicable when a very extreme storm event is involved, like typhoon Morakot event in 2009 in southern Taiwan.