

Earthquake-induced deformation, Instability and Failure Patterns of Rock Slope revealed by Shaking Table Test

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The initial deformation characteristics, further instability, and final failure patterns of rock slope subjected to seismic load are related to the geomaterials, geological structure, geometry of slope and seismic condition. The classifications of rock slope failure patterns related to earthquake magnitude can be divided into rock fall, rock block slide, rock slide, rock slump and rock topple (Keefer, 1984). To explore the seismic behaviors of rock slope, a series of shaking table tests of scaled rock slope physical models on an inclined base plane and with two joint sets being mutually perpendicular to each other were conducted. In addition, the acceleration responses on the top, bottom and half height of the slope model were recorded, and the images of the model were captured simultaneously during the shaking table tests. All of the captured images were analyzed by PIV (Particle Image Velocimetry) method to acquire the velocity, acceleration and initial deformation characteristics of the slope model.

The experimental results show that (1) the peak acceleration responses on the top of slope model are greater than those on the other positions; (2) the captured images and PIV analysis demonstrate that the deformation characteristics are dependent on the angle of the inclined base plane and the peak ground acceleration (PGA); (3) the failure patterns including toppling, rock fall and rock block sliding are observed. Furthermore, a PIV verification procedure is proposed to ensure the accuracy of the velocity and acceleration acquired from PIV analysis.

Keywords: Rock Slope, Deformation Characteristics, Shaking Table