



DEM Simulation of Rock Shed Failure due to Rockfall Impact

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The rock shed is a more costly but effective traffic facility used to keep out falling rocks in Taiwan. The main function of rock shed is to let the falling rock passing through via the top slab without hitting the road users. The failure mode of the rock shed due to rockfall impact generally includes punching of top slab, flexural cracks of beam, buckling of column, and damage of foundation, etc. Even so, the failure behavior of the rock shed is still complicated and difficult to predict.

Accordingly, this study adopts the discrete element program (PFC2D) to simulate the failure behavior of rock shed. A comparison with uniaxial compression test was carried out firstly to determine the micro parameters of structure elements. The model was utilized to simulate the behavior of rock shed with impact load or hitting of falling block separately. Then, a case study of present rock shed of highway NO.18 in middle Taiwan was analyzed.

The result indicates that: the primary causes of rock shed failure mode include block size, falling height, impact position, and structure system. The failure mode of punching shear failure or flexural cracks is dominated by block size and falling height. The occurrence of differential settlement is related to impact position and absence of combined footing. Considering the connection of beam and column, the structure is more likely to break at the joints rather than punching of the top slab. As a result, combined footing and beam-to-column joint should be to take into account to obtain safer protection of rock shed.

Keywords: rockfall disaster, PFC, rock shed, discrete element method