

Topping Failure Analysis of Anti-Dip Bedding Rock Slopes Subjected to Crest Loads

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Abstract : Crest loads are often encountered in hydropower, highway, open-pit and other engineering rock slopes. Toppling failure is one of the most common deformation failure types of anti-dip bedding rock slopes. Analysis on such failure of anti-dip bedding rock slopes subjected to crest loads has an important influence on engineering practice. Based on the step-by-step analysis approach proposed by Goodman and Bray, a geo-mechanical model was developed, and the related analysis approach was proposed for the toppling failure of anti-dip bedding rock slopes subjected to crest loads. Using the transfer coefficient method, a formulation was derived for calculating the residual thrust of slope toe and the support force required to meet the requirements of the slope stability under crest loads, which provided a scientific reference to design and support for such slopes. Through slope examples, the influence of crest loads on the residual thrust and sliding ratio coefficient was investigated for cases of different block widths and slope cut angles. The results show that there exists a critical block width for such slope. The influence of crest loads on the residual thrust is non-negligible when the block thickness is smaller than the critical value. Moreover, the influence of crest loads on the slope stability increases with the slope cut angle and the sliding ratio coefficient of anti-dip bedding rock slopes increases with the crest loads. Finally, the theoretical solutions and numerical simulations using Universal Distinct Element Code (UDEC) were compared, in which the consistent results show the applicability of both approaches.

Keywords : anti-dip bedding rock slope, crest loads, stability analysis, toppling failure

Conference Title : ICGEG 2018 : International Conference on Geotechnical Engineering and Geomechanics

Conference Location : Sydney, Australia

Conference Dates : December 03-04, 2018