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Slope Stability and Landslides Hazard Analysis, Limitations of Existing Approaches, and a New Direction

Authors : Alisawi Alaa T., Collins P. E. F.

Abstract : The analysis and evaluation of slope stability and landslide hazards are landslide hazards are critically important in civil engineering projects and broader considerations of safety. The level of slope stability risk should be identified due to its significant and direct financial and safety effects. Slope stability hazard analysis is performed considering static and/or dynamic loading circumstances. To reduce and/or prevent the failure hazard caused by landslides, a sophisticated and practical hazard analysis method using advanced constitutive modeling should be developed and linked to an effective solution that corresponds to the specific type of slope stability and landslides failure risk. Previous studies on slope stability analysis methods identify the failure mechanism and its corresponding solution. The commonly used approaches include used approaches include limit equilibrium methods, empirical approaches for rock slopes (e.g., slope mass rating and Q-slope), finite element or finite difference methods, and district element codes. This study presents an overview and evaluation of these analysis techniques. Contemporary source materials are used to examine these various methods on the basis of hypotheses, the factor of safety estimation, soil types, load conditions, and analysis conditions and limitations. Limit equilibrium methods play a key role in assessing the level of slope stability hazard. The slope stability safety level can be defined by identifying the equilibrium of the shear stress and shear strength. The slope is considered stable when the movement resistance forces are greater than those that drive the movement with a factor of safety (ratio of the resistance of the resistance of the driving forces) that is greater than 1.00. However, popular and practical methods, including limit equilibrium approaches, are not effective when the slope experiences complex failure mechanisms, such as progressive failure, liquefaction, internal deformation, or creep. The present study represents the first episode of an ongoing project that involves the identification of the types of landslides hazards, assessment of the level of slope stability hazard, development of a sophisticated and practical hazard analysis method, linkage of the failure type of specific landslides conditions to the appropriate solution and application of an advanced computational method for mapping the slope stability properties in the United Kingdom, and elsewhere through geographical information system (GIS) and inverse distance weighted spatial interpolation(IDW) technique. This study investigates and assesses the different assesses the different analysis and solution techniques to enhance the knowledge on the mechanism of slope stability and landslides hazard analysis and determine the available solutions for each potential landslide failure risk.

Keywords : slope stability, finite element analysis, hazard analysis, landslides hazard
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