

三維邊坡穩定樁受震行為模擬分析

黃鈞暉^[1] 陳建元^{[2]*}

摘要 本研究使用 FLAC3D 程式，探討邊坡穩定樁各項樁土參數對於穩定邊坡的影響，以剪力強度折減法計算邊坡安全係數進行靜態分析，及以位移量進行動力分析。分析中以有間隔之排樁進行模擬，觀察土壤-基樁參數之變化對拱效應現象及邊坡安全係數的影響。分析結果顯示，樁淨間距(S_c)以及土壤強度參數為影響拱效應現象之關鍵因素，樁淨間距(S_c)超過 3m 時拱效應現象會消失如同單樁，土壤摩擦角越大，拱效應現象越明顯，土壤凝聚力對拱效應現象則不明顯，設計樁間距與直徑比(S/D)時，除了考慮土壤性質與材料因素及地震等因素後，建議採 $S/D \leq 2$ 時有較顯著拱效應。邊坡加樁後可能改變邊坡之破壞型態由深層崩塌轉換為淺層崩塌，對邊坡之安全係數受崩塌類型影響而可能降低。

關鍵詞：邊坡穩定、樁基礎、拱效應、耐震設計。

Landslide Stabilizing Pile Behavior Modeling under Seismic Loading

Jun-Wei Huang^[1] Chien-Yuan Chen^{[2]*}

ABSTRACT Piles used to stabilize the slope are commonly used in Taiwan. In this study, the FLAC3D program is used to explore the effects of the soil-pile parameters of a landslide stabilizing pile that affects the stability of the slope. To calculate the safety factor of the slope, the static analysis is conducted using the shear strength reduction method while the seismic analysis uses displacement. The analysis modeled the changes in pile spacing based on the effects of arching and the safety factor of the slope. The results showed that the pile's clear spacing (S_c) and soil shear strength parameters are critical parameters that affect arching. A wider clear spacing (S_c) of pile makes arching disappear and the pile responds as a single pile. With a larger soil friction angle, arching is more obvious. However, as soil cohesion increases, arching becomes less obvious. The design of the pile spacing and the diameter ratio (S/D) is a crucial factor in the formation of arching effects. This study suggests $S/D \leq 2$ should be used for the design of landslide stabilizing piles. Such landslide stabilizing piles could change the failure mode of the slope from a deep seated landslide to a shallow landslide and the factor of safety of slope reduced..

Key Words : Slope stability, pile foundation, arching effect, seismic design.

[1] 國立嘉義大學土木與水資源工程學系碩士

Master, Dept. of Civil and Water Conservation Engineering, National Chiayi University, Chiayi City 60004, Taiwan

[2] 國立嘉義大學土木與水資源工程學系教授 (* 通訊作者 E-mail: chienyuc@mail.ncyu.edu.tw)

Professor, Dept. of Civil and Water Conservation Engineering, National Chiayi University, Chiayi City 60004, Taiwan