

台北縣金山鄉葵扇湖地區熔岩流之工程性質與其邊坡穩定性研究

The study of the engineering properties and the slope stability of the lava flow in Kuishanhu,
Chinshan area of Taipei county

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摘要

本研究區位於台北縣金山鄉葵扇湖地區之西南側，為民國八十九年十一月一日象神颱風所引發之一大型崩塌邊坡。此崩塌坡體之地質材料主要為熔岩流與火山碎屑岩所組成，岩性以兩輝安山岩為主。熔岩流的節理相當發達，其 3 組位態分別為(1) J1 : N75°W / 72°N，(2) J2 : N60°E / 70°N 以及(3) J3 : N60°E / 73°S。本研究區可分為破壞區與堆積區，前者包括有主坍塌、次坍塌與主體三部分，坡度介於 42°至 78°之間。破壞區長度 150m，高程落差 175m。堆積區長度 250m，高程落差 20m，其範圍包括趾部與落石堆積區，坡度介於 0°至 15°之間。本研究工作便嘗試以地質調查、地質材料試驗以及邊坡穩定的分析方式，來了解整個崩塌坡體之地質材料特性及其崩塌的機制。

此研究方法可分為四部份，(1)現地調查，包括地質、地貌調查、基質貫入試驗、史密特錘試驗，以及現地樣品採集等工作。(2)室內實驗，包括自然物理性質與力學性質試驗兩部分。(3)穩定性分析，使用 GEO-SLOPE 程式，以坡體現地調查之各項條件及參數，計算其安全係數值的變化。(4)崩塌機制探討，最後將上述各項調查的結果進行整合，並分析本研究坡體的崩塌機制。

在坡體穩定性分析方面，由立體投影分析結果顯示，本研究區坡體具有楔形模式的破壞潛能。由極限平衡分析法發現，本研究區坡體在乾燥情況下為處於一穩定狀況。當坡體之孔隙水壓係數增至 0.8 以上時，其安全係數值將小於 1.0，即坡體將趨向於破壞狀態。另外，從坡體破壞變形的研究中也同時發現，本研究區的塑性變形區是分布於熔岩流與凝灰角礫岩的交界處，此意義顯示本坡體之破壞方式主要是沿著上部熔岩流間的節理面產生，當豪雨作用時，大量之地表水會順著坡體內節理面入滲而呈現飽和狀況，又由於坡體的地質材料中含有高比例的伊萊石與少量的澎潤石等具高度吸水性並容易產生膨脹性的黏土礦物，對於坡體之穩定性亦會產生負面的影響。

Abstract

A huge slope failure occurred in Kuishanhu of Chinshan area after Xangsane typhoon on 1st Nov, 2000. The mainly composition of study area are lava flow and pyrocrastic rock. The study area is divided into two divisions, one is failure zone and the other is accumulated zone. The failure zone includes three parts: major scarp, minor scarp and main body. The length of the failure zone is 150m and the slope grade ranges from 45° to 82°. Three sets of joints are (1) N60°E/ 80°N, (2) N60°W/78°S and (3) N8°W/11°N. The accumulated zone includes two parts: foot and deposition area. The length of the accumulated zone is 250m and the slope grade ranges from 0° to 15°. The methods of this study area are : (1) in-situ investigation, (2) laboratory testing, (3) stability analysis, and (4) mechanism analysis.

The stereonet analysis shows that the discontinuities of three sets display the potential failure model of wedge type in the study area. The results of limit equilibrium method show that the safety factor will decrease as the water level ratio raising. The results of finite element method could illustrate the failure surface of slope is extended along the jointed plane. The water would permeate into the slope more easily by those joints and the slope would be unstable then. And the rock materials contain amount of clay minerals, such as illite and smectite. It could also be one of the reasons to affect the stability of the slope.