

南投縣九份二山地區岩石材料之工程地質特性研究

The Study of the Engineering Geological Characteristics of Rock Material in
Juo-Feng-Err-Shan of the Nantou Area

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摘要

南投縣九份二山地區在 921 地震當時產生了大規模之順向坡地層滑動災害，並且形成了長 2100 公尺，寬 1000 公尺的殘留滑動面。而本研究工作是嘗試利用實驗室內之試驗工作來瞭解滑動面上岩石材料之工程地質特性。這些特性包括 (1) 自然物理性質，(2) 岩石組構，(3) 礦物成分，以及 (4) 力學性質等四項工作。

在自然物理性質方面，主要包括 (1) 含水量，(2) 孔隙率，(3) 單位重，以及 (4) 液、塑性限度等四方面。本研究工作分別將各項試驗結果與消散耐久性、點荷重強度以及基本摩擦角作相互的分析探討，其結果顯示除了點荷重強度會著隨含水量的增加而有降低的趨勢之外，其餘各項自然物理性質與力學性質間的相關性並不明顯。

而岩石組構方面，本研究分別從 (1) 顆粒圓度、(2) 顆粒粒徑，(3) 顆粒堆疊方式，以及 (4) 顆粒彼此間的接觸型態等四方面，分別探討其對消散耐久性、點荷重強度、基本摩擦角等力學性質的影響。研究結果顯示，顆粒圓度與各項力學性質間的關係性並不明顯。而顆粒粒徑不但與消散耐久性間有著明顯的負相關趨勢之外，同時與岩石材料的基本摩擦角間亦有著正相關的趨勢。在顆粒堆疊方式方面，堆疊相鄰關係與點荷重強度間呈現負相關的趨勢。另外，本研究中岩石材料之顆粒接觸型態主要以不接觸型態為主，而且不接觸的相對含量也與點荷重強度間呈現明顯的正相關趨勢。當顆粒接觸型態中直線型、嵌合型的含量增加時，或是相切型、縫合型以及不接觸的含量減少時，往往具有較高之基本摩擦角。

在礦物成分方面，除了石英的含量與基本摩擦角間有著正相關的趨勢之外，四種黏土礦物的相對含量與點荷重強度及基本摩擦角間，同樣具有一定的關係性存在。其中當高嶺石的含量愈多或是膨潤石的含量愈少時，具有較高的點荷重強度。而當依萊石的含量增加或是膨潤石的含量減少時，也具有較高之岩石材料基本摩擦角。

關鍵詞：九份二山、岩石材料、工程地質特性、順向坡

Abstract

The large scale disaster of dip slope failure had occurred in the Juo- Feng- Err-Shan of Nantou area during 921 earthquake, and generated a length 2100m and wide 1000m relict slip surface. And this study try to use laboratory experiments to understand the engineering properties of rock materials on the slip surface. The engineering properties include 4 items: (1) physical properties, (2) rock textures, (3) mineral composition, and (4) mechanical properties.

The physical properties includes 4 items: (1)water content, (2) porosity, (3)unit weight, and (4) liquid and plastic limit. The study discusses the relationship between these physical properties and slake durability properties, point-load strength and the basic friction angle. The results demonstrate that the point-load strength will decrease with the water content increase, and the other physical properties seem no relationship with mechanical properties.

The rock textures in this study also includes 4 items: (1) grain roundness, (2) grain size, (3) grain packing, and (4) grain contact. The results of regression analysis demonstrate that except the grain roundness, all of the other rock textures have clear relationships with mechanical properties. These relations include: the grain size is negative with point-load strength, and positive with basic friction angle. The packing properties is negative with point-load strength. On the other hand, in the study although the main grain contact of rock material is non-contact, the relative content of each contact type has clear relationship with point-load strength and basic friction angel.

The mineral composition of this study, try to discuss (1) quartz content and (2) clay minerals relative content with mechanical properties. The results of regression analysis demonstrate that not only the quartz content is positive with basic friction angel, but also the relative content of clay minerals have deeply relationships with point-load strength and basic friction angel. When the relative content of kaolinite increase or the smectite decrease, the point-load strength will increase. And when the relative content of illite increase or the smectite decrease, it will increase the basic friction angel of rock.

Key words: Juo-Feng-Err-Shan, rock material, engineering geological characteristics , dip slope