

研究生：柴鈞武

學號：88542002

論文名稱：梳子壩防治土石流之水理特性及其效率評估模式

英文論文名稱：The Hydraulic Characteristics and Efficiency Assessment
of the Slit Dam in its Prevention Against Debris Flows

【中文摘要】

本論文根據輸砂力學理論中泥砂顆粒起動之觀念，建立了土石流臨前泥砂體積濃度之理論模式，以表徵土石流泥砂體積濃度與溪床坡度之關係；另由渠槽試驗證實了泥砂體積濃度比與土砂流出率之互動機制，並結合壩體貯砂率以作為梳子壩防治土石流效率評估指標；最後利用上述之土砂流出率、泥砂體積濃度比及壩體貯砂率等防治效率指標，建立了梳子壩開口寬度的設計流程及其線解圖，針對不同的土砂流出率，可以簡便地設計出其對應之壩體開口寬度。

同時，基於下游被保護地區之安全考量，而要求梳子壩必須具備轉化土石流成為較無危害性的一般挾砂水流時，其壩體開口寬度之限制性水流出流設計及線解圖亦已發展，可以提供工程設計之參考。依據壩體開口寬度、總開口寬度及有效壩高等相關幾何參量的設計模式，結合溪流地形、幾何形態及溪床質等調查資料，可說明梳子壩各相關幾何參量之計算步驟及設計流程。

此外，針對土石流過壩後之土砂『數量』及『本質』的變化規律，進行渠

槽試驗和理論驗證，結果顯示：當過壩水流之泥砂體積濃度比越小，其沖刷下游床面泥砂就越激烈；當土石流土砂流出率越大時，因攜出土砂量仍相當地大，水流泥砂含量亦高，故其沖刷下游床面泥砂之趨勢將趨於緩和；另依據壩體開口處土砂堆疊情形，可獲得壩體上游淤砂水力排除之臨界相對開口寬度；當壩體開口寬度越大，其貯砂效果越低，且於壩體開口處之泥砂顆粒常形成約四分之一球體狀之陷坑，此時只要上游有足夠之清水流量配合，即可清除部分淤砂。

【英文摘要】

This dissertation is based on the concept of sediment transport mechanics theory and incipient motion of gravel particles, and the theoretical model of volume concentration of the solid in debris flow before passing sabo dam was erected. The model indicates the relation between volume concentration of the solid in debris flow and the channel slope. Also the interaction mechanism between volume concentration of the solid and sediment flow rate is obtained through experimental flume. By using the efficiency assessment such as sediment flow rate, volume concentration ratio of the solid, storage of dam and volume concentration of the solid in debris flow before passing sabo dam, the design flowchart and design model of the width of the sabo dam can be constructed. For different sediment flow rates, the different width of the sabo dam can be easily designed. Also for the safety of the down-stream protection area, the sabo dam is required to transfer debris flow to less harm sediment flow.

The design model of dam width and sediment flow are developed for the engineering design reference. According to the opening width of dam, the summation opening width of dam and effective dam height, a sample case is studied. This case includes the channel slope, geometrical condition and bed material data to indicate the determination steps designing flowchart of sabo dam.

Further more, the regular changes of sediment quantity and quality of debris flow after passing sabo dam are studied by experimental flume and theoretical proving, and the results show that the smaller volume concentration of sediment passing through sabo dam has the stronger sediment flushing effect at downstream is found. Also when the sediment flow rate of debris flow is high, the sediment content is high due to the high quantity of carrying sediment. This will result in smooth tendency of flushing at downstream. Besides, the critical dam width at upstream hydraulic sediment sluicing can be obtained, according to the sediment accumulation at dam opening. The bigger the opening is the lower storage effect will be. At the dam opening the solid sediment usually forms a circle cave of 1/4 ball body, and the sediment will be cleared when sufficient water flow at upstream is availabl