

## 水力類土石流發生模式之研究

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**摘 要** 本研究從無限邊坡斜面堆積土體之力學機制出發，建構了邊坡斜面堆積土體的崩壞模式及其轉化成爲土石流的臨界坡度。根據研究結果顯示，邊坡斜面堆積土體崩壞型式依其地表逕流而有水力類和土力類之分，若已知土體條件：固體泥砂顆粒單位重  $\gamma_s = 2.6 \text{ g/cm}^3$ 、床面靜止泥砂體積濃度  $C_* = 0.7$ 、動摩擦係數  $\tan \alpha = 0.6$  及靜摩擦係數  $\tan \phi = 0.75$  時，則當溪床坡度小於 39.4% ( $\approx 21^\circ$ )，邊坡斜面堆積土體係以水力類崩壞型式爲主，且若引入土石流之最小泥砂體積濃度，此崩壞土體可轉化成爲水力類土石流的溪床臨界坡度  $\tan \theta_c \geq 23.1\%$  ( $\approx \theta_c \geq 13^\circ$ )，但是當溪床坡度小於 23.1% 時，亦可能通過能量累積而以挾砂超載方式，使在較小的床坡條件下形成緩坡土石流。爲此，本研究乃自輸砂力學探討緩坡土石流之發生機理，尤其是溪流間歇性土砂運動轉化土石流之機理，提出初步的看法。由於緩坡土石流概念尙屬萌芽階段，雖然已證實存在於若干土石流溪流，惟其理論機制仍有待開展。

**關鍵詞：**土石流、水力類崩壞、土力類崩壞、緩坡土石流。

## Occurrence Model of Debris Flows Triggered by Water Power

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**ABSTRACT** From the mechanical mechanism of an infinitely long sediment layer of uniform depth, this study proposes the failure model of the sediment layer and its respective critical slope for the occurrence of debris flow. The results indicate that failures of sediment layers can be categorized as water-power type and soil-power type according to the surface runoff condition. Failures are most likely the water-power type when the channel-bed slope is less than 39.4%. Furthermore, when considering the minimum volume concentration of debris flow, the channel slope of 23.1% will be used as the critical value of forming water-power type debris flow. However, even with the channel slope smaller than 23.1%, the mild-slope debris flow can be triggered by the accumulating potential energy and over-loading sediments. According to the properties of mild-slope debris flow, this study also developed its occurrence model through the mechanics of sediment transportation and the phenomenon of intermittent flow. Despite having its occurrence proved in many debris-flow creeks, the concept of mild-slope debris flow still needs to be further developed.

**Key Words:** debris flow, water-power type failure, soil-power type failure, mild-slope debris flow.

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