中華水土保持學報, 38(4): 349-371 (2007)
Journal of Chinese Soil and Water Conservation, 38 (4)*:349-371* (2007)

混合粒徑輸砂量估算之研究

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摘　　要　過去對於輸砂量模式之研究大多探討均勻粒徑之沉滓運移，對於混合粒徑者甚少討論。因此，本研究則採用混合粒徑進行輸砂量試驗並觀察試驗過程中泥砂運移現象，發現混合粒徑渠床對於不同水流作用會產生不同程度之分選或遮蔽效應。

本研究取$\sigma = 1.5$當作均勻與混合粒徑之判斷標準，將本研究所從事$\sigma = 2.54$之 25 組渠槽試驗數據，並配合目前國內外渠槽資料中σ>1.5 之混合粒徑試驗 283 組資料，共 308 組混合粒徑試驗數據，重新迴歸分析討論，以推得一考慮單寬流量、坡度及粒徑分佈因子之臨界流量與沉滓運移模式：

$$\frac{q_c}{\sqrt{(\frac{\rho_s}{\rho}-1)gD^3}} = 1.349\cdot(S)^{-0.807}\cdot(D_g)^{-0.182}\cdot(\sigma)^{0.116}$$

$$\frac{q_s}{q-q_c} = 3.174\cdot(S)^{2.134}\cdot(D_g)^{-0.248}\cdot(\frac{h}{D})^{0.513}\cdot(\sigma)^{1.335}$$

式中：

q_c=臨界流量（cms/m）；D_g=無因次沉滓粒徑參數；S=坡度；

σ=泥砂粒徑分佈因子；q_s=推移質輸砂量（cms/m）；h=水深（m）；

q=流量（cms/m）；D=泥砂粒徑（m）

經與前人輸砂量模式進行驗證比較，可知本研究所推導出之輸砂量模式，無論在均勻或混合粒徑試驗資料上，較其他各家輸砂模式更吻合試驗數據，因此，利用本研究所推導之輸砂模式對均勻或混合粒徑均可以普遍提供良好之推估結果。

關鍵詞：混合粒徑、渠槽試驗、輸砂量。

Estimation of Mixed-Grain Sediment Discharge

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ABSTRACT　Most experts have discussed the uniform-grain sediment transport models but few have analyzed the mixed-grain sediment transport models. Therefore, this study used mixed-grain as the material to carry out a sediment transport flume experiment and observe the motion of sediment in the process of the experiment. We could find mixed-grain in the channel-bed showed a different sorting or hiding phenomenon in the different flow discharges.

This study selected standard deviation $\sigma = 1.5$ to separate uniform-grain from mixed-grain. According to the 25 experimental data that is standard deviation

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$\sigma = 2.54$ of this study and 238 existing flume data that is standard deviation $\sigma > 1.5$ collected from home and abroad, we derived the models for critical discharge and sediment transport conducting unit effective flow discharge, slope and gradation coefficient by multiple regression analysis.

$$\frac{q_c}{\sqrt{(\frac{\rho_s}{\rho}-1)gD^3}} = 1.349 \cdot (S)^{-0.807} \cdot (D_g)^{-0.182} \cdot (\sigma)^{0.116}$$

$$\frac{q_s}{q - q_c} = 3.174 \cdot (S)^{2.134} \cdot (D_g)^{-0.248} \cdot (\frac{h}{D})^{0.513} \cdot (\sigma)^{1.335}$$

in which,

q_c = critical discharge（cms/m）；S= slope, σ= gradation coefficient,

D_g= dimensionless grain parameter, q_s= sediment transport discharge（cms/m）,

q= flow discharge（cms/m）, D= sediment grain (m), h= water depth (m)

After verification and comparison, the model of this study matched more closely with the experiment data of both uniform and mixed grain than the existing sediment transport models. Therefore, using the sediment transport model derived in this study could provide a reasonable result for estimating uniform or mixed grain sediment transport.

Key Words: mixed grain size, flume experiment, sediment discharge.