UNIVERSITI TEKNOLOGI MARA

SOIL ERODIBILITY OF HETEROGENEOUS RIVER BANK PROFILE TO LATERAL MIGRATION

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ABSTRACT

Lateral migration changes are very complex and complicated processes. There are consistent underlying relationships between lateral migration and other parameters such as soil erodibility, hydraulic and hydrodynamic characteristics, river bank geometry, soil properties, grain or flow resistance, planform characteristics and others. Soil erodibility plays a significant role in streambank erosion and lateral changes. It is a derivative of the physical, geochemical and biological properties and the impact of applied stresses on these derivatives is of primary concern. The controlling forces resisting hydraulic stresses generated by flowing water are a measure of soil erodibility. This study consists of two primary stages. Initially, a newly modified version of the JET device namely Jet Erosion Device (JEd) is fabricated, with improved features and design that facilitates testing in the field and the laboratory. Soil erodibility coefficients are introduced to represent the erodibility of the soils under study. Field data measurements were carried out on 3 rivers where empirical models were developed using data from Selangor River and validated using data from Bernam and Lui rivers and other secondary river data. Analyses have shown high correlations and the parameters were further examined and analysed for the development of a predictive relationship for Jet index, J_i using discrepancy ratio (DR) as the validation method. The second stage of this study investigates the lateral migration characteristics and the related parameters specifically focussing on soil erodibility parameter under study. Primary and secondary data was collected to obtain sufficient amount of information for variables in order to explain the controls on temporal changes of lateral migration. At this stage, Selangor River was selected for the lateral migration rates measurement. Statistical analyses were then conducted using the variables obtained through dimensional analysis to identify the relationship of lateral channel migration with the hydraulics, channel and soil erodibility characteristics. Statistical multiple regression analyses were performed to establish the empirical equation of lateral channel migration based on the selected dependent and independent variables with the incorporation of the soil erodibility parameters. Statistical parameters such as coefficient of determination, R^2 and root-mean-square error (RMSE) percentages were used to aid in the selection of the most appropriate model. The predictive variables selected were based on their ability to explain the variation of lateral channel migration. Once a mathematical model in a form of predictive equation was produced based on the regression of the field data, the results were interpreted and checked against any physical data. This validation process was done with field monitoring data and available secondary data. The analysis concluded that the dimensionless soil erodibility parameter obtained through the JEd experiments on site is most likely show a significant relationship with lateral migration rates.

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