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Title : STREAMBANK EROSION PREDICTION USING EMPIRICAL MODEL FOR NATURAL RIVER CHANNELS

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Streambank erosion is commonly associated with river meandering initiation and development, through width adjustment and planform evolution. It consists of two types of erosion mechanism; basal erosion due to fluvial hydraulic force and bank failure under the influence of gravity. These processes require an intergration between soil-water interactions to properly understand the factors constitutes to streambank erosion and its impact to major scouring. A study was undertaken to explore the rates of streambank erosion and the factors of streambank erosion. Fieldwork investigation technique was conducted in the quantification of streambank erosion rates. Field data has been extracted from two streams which have been identified as the area susceptible to streambank erosion, namely, Sg. Bernam and Sg. Lui, both located in states of Selangor, Malaysia. Measurement of streambank erosion rates has been conducted using short-time scale field technique. Conventional erosion pin arrays, repeated cross-profiling and vertical streambank profiling were employed in order to obtain the streambank erosion rates. The fieldwork data obtained from fieldwork erosion monitoring served as a pilot inventory streambank erosion data for both site areas. Dimensional analysis is performed to establish the factors governing streambank erosion. Two functional relationships addressing streambank erosion rates incorporating factors of hydraulic characteristics, resistance to the soil, streambank gemotery, grain and sediment resistance were established using Buckingham PI theorem using two sets of repeating variables. Selection of the most significant parameters constitutes to streambank erosion rates is obtained from the analysis. Results from the analysis concluded eleven dimensionless parameters as factors governing streambank erosion rates. Further objective focused on the development of newly streambank erosion expression using empirical approach. A total of 318 data were used in the model development. Three methods have been employed in the model development, namely, (i) Statistical approach using multiple linear, nonlinear regressions, and logartithmic transformation function; (ii) Linear Least Squares (LLS) solution for Nonlinear Autoregressive Exogenous (NARX) using QR factorization parameter estimator; and, (iii) Artificial Neural Network (ANN) method. The established models were validated to assess their performaces in predicting the rates of streambank erosion. 176 data were used in the model validation. The performance of the developed equations was assessed using three criteria, namely, (i) discrepancy ratio (ratio of predicted values to the measured values); (ii) statistical test analysis; and, (iii) graphical analysis. Validation of the developed equations confirmed that ANN model gave very good prediction where all data lie within the line of perfect agreement of the discrepancy ratio limit of 0.5 to 2.0, for both Model no. 1 and 2. Other models (statistical and NARX model) predicted equally good performance ranging from 70% - 90% accuracy. Further analysis is required to test the developed model specifically for different river characteristics. However, the availability of data is a hindrance and to draw these findings, further recommendations are summarized for the validity of the derived equations.