A physical model study on bed-load flux prediction in a bifurcated channel

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1.ABSTRACT

An experimental investigation on a scaled physical model of the Kangsabati River bifurcation has been carried out to provide the basis for the development of a dimensionless bed load function and for testing a simple predictive model. The sets of data for the Old and New Kasai branch from the model experiment has been collected for the mean size of sediment 0.19mm with the range of discharges from 0.002 to 0.010 cumec. The experimental result shows that the sediment transport rate is a function of the stream power. Despite differences in bed slope of the Old and New Kasai branch, the data yield very similar power relationships (exponents of 0.331 and 0.357) between unit discharge and bed load flux. The model experiments show that there is a clear relationship between dimensionless total bed load flux and dimensionless stream power, for a range of flow conditions, slope, and grain size.

2.INTRODUCTION

Prediction of bed load flux remains a significant problem in understanding braided river morphodynamics for geomorphic and engineering applications. A scaled physical model experiments on bifurcated networks to predict the bed-load flux performed at River Research Institute (RRI), Nadia, West Bengal, India. The horizontal and vertical scale ratio of physical model set-up are 1: 350 and 1:70 respectively and comprised of three branches: a main branch (Kangsabati) which bifurcates into two branches; Old Kasai and New Kasai. The slope of the main Kangsabati is 0.000246 (m/m) and the slope of bifurcated branches i.e., Old Kasai is 0.000875 (m/m) and New Kasai is 0.0015 (m/m) (WAPCOS Ltd. 2009). The present physical model study shows a relationship between stream power and bed-load flux.

3.RESULTS & HIGHLIGHTS OF IMPOINTANT POINTS

The experimental set-up run with a range of discharge from 0.002 to 0.010 cumec with injecting sediment size of 0.19mm in the main branch (Kangsabati). The model bed was set up with the selected sediment size before starting. The model was force feed with sediment at rates estimated by theoretical sediment bedload equations. The experimental run was continued with the corresponding discharges for prepared model bed with chosen sediment until regime flow prevail. The transported sediment deposited in the sand traps situated downstream of the bifurcated branches were used to estimate the bedload transport for each branch. Formulas were entered into spreadsheet cells to calculate dimensionless sediment flux and stream power for Old and New Kasai at each of the selected flow are shown in Figure 1. The two data set of Old and New Kasai branch can be compared more directly using dimensionless variables for stream power and bed load flux to predict the bed-load rate. The dimensionless data collapse to a single relationship fits both data sets as shown in the figure 2 which predict the bed-load transport rate.

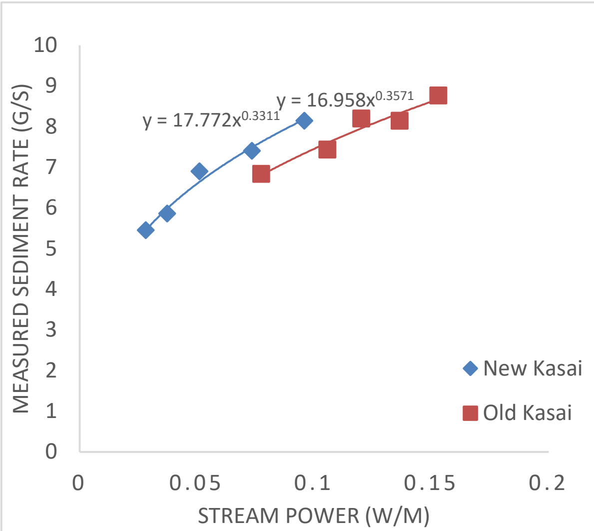

Figure 1: Sediment transport rate as a function of the stream power.

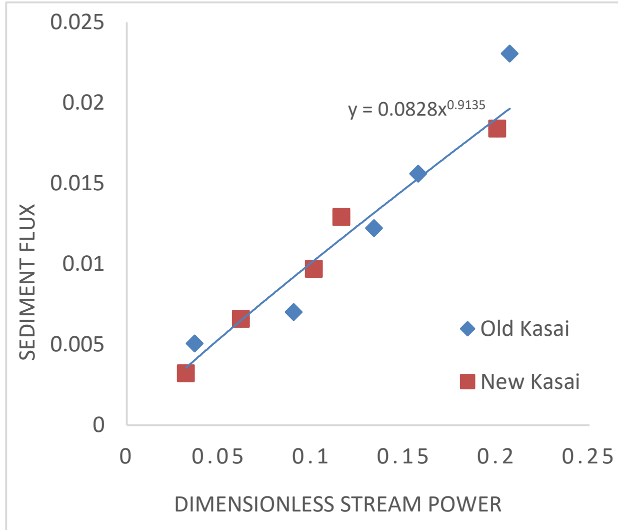

Figure 2: Sediment flux as a function of the dimensionless stream power

4. CONCLUTION

This experimental study has been done with range of discharge from 0.002 to 0.010 cumec with sediment size of 0.19mm. A set of data collected during experiment and with the observed data the following conclusions are drawn:

- The experimental result shows that the sediment transport rate as a function of the stream power.
- The two data sets for Old and New Kasai can be compared more directly using dimensionless variables for stream power and bed load flux. The dimensionless data collapse to a single relationship fits both data sets which predict the bed-load transport.

5.REFERENCES

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