STAGE-DISCHARGE CURVE AND ITS PREDICTION IN COMPOUND CHANNELS

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Stage-discharge curve plays an important role in hydraulic design and exploiting computational procedures for estimating the conveyance capacity of flood channels. When water in a main channel flows out of bank, stage-discharge curve becomes more complicated. The lateral exchange of momentum between the main channel and the floodplains makes the total conveyance capacity decrease. Otherwise, conventional methods don't consider the momentum transfer. Hence, in assessing the conveyance capacity, adopting either cross-sectional division method or single channel method will result in enormous error.

For the complex behavior of overbank flow, it is necessary to understand the relationship between stage and discharge, and variation of Manning's *n* with stage for inbank and overbank flow. Hence, the authors have constructed a hydraulic experiment. The experimental work at Sichuan University has been carried out in a 50 m long, 6 m wide and 1m deep large-scale channel, with discharge up to 0.470 m^3/s. The symmetric straight compound channel was constructed by concrete. It was 40 m long and 3 m wide. The central channel depth was 0.20 m at bankfull discharge and maximum depth may reach 0.40 m. The bed width of the main channel was 0.8m in all the tests. The main channel side slope, S3, was 1.75 (horizontal: vertical) and floodplain side slope, S1, 0. The bed slope was fixed at 0.002. Depths in the central measuring section was measured by using a point gauge reading to the nearest 0.1 mm. The measured stage-discharge curve is shown in Fig. 1. The Manning's *n* varies complexly with stage, shown in Fig. 2.

To predict the stage-discharge relationship, the authors applied Vensim PLE Plus to establish system dynamics model of conveyance capacity without feedbacks, shown in Fig. 3. In the model, the major factor was Darcy-Weisbach resistance coefficient in the main-channel zone, main-channel-side-slope zone, flood-plain zone and flood-plain-side-slope zone, i.e. f_1, f_2, f_3 and f_4. The friction factors in every subzone were determined according to the obtained equations (Yang etc, 2005). The authors applied the model to simulate the conveyance capacity and obtained good results.

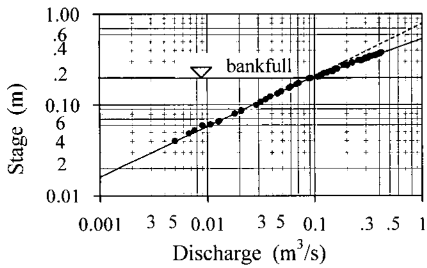

Fig. 1 Stage-discharge curve

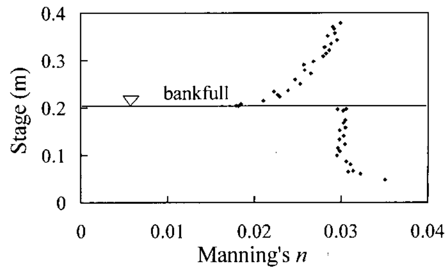

Fig. 2 Variation of composite Manning's n with stage

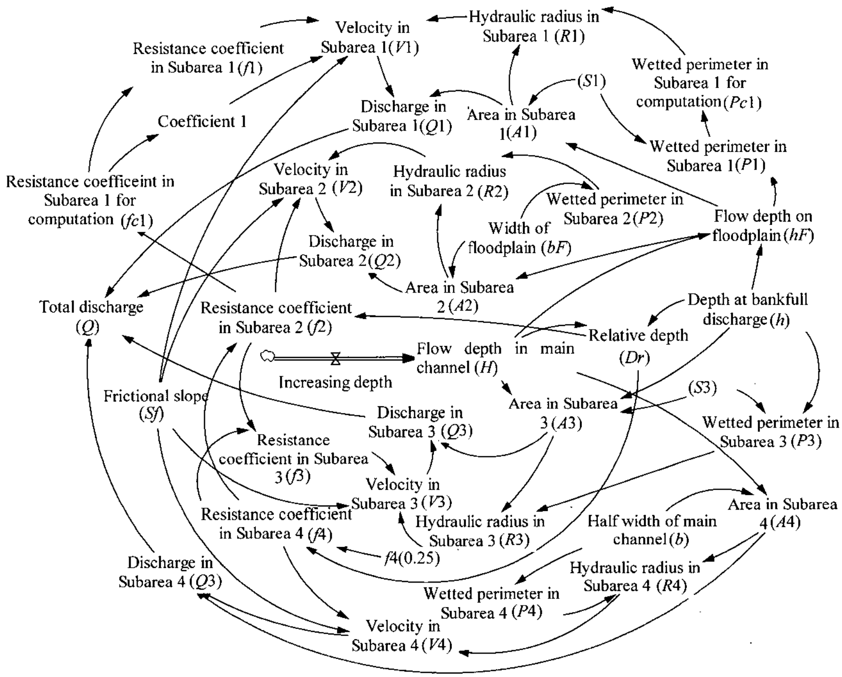

Fig. 3 Structure of system dynamics model of conveyance capacity

REFERENCES

Yang K.J., Cao S.Y., Liu X.N., 2005. Computation of resistance coefficient and conveyance capacity in compound channels. Advance in Water Science, 16(1), pp.23-27 (in Chinese).