NAVIGABLE CHANNEL CHARACTERISTICS IN BRAIDED STREAM WITH NARROW PASS

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1. INTRODUCTION

The spatiotemporal change characteristics of rivers is necessary to be understood for river managements. Braided channels are very unstable channels temporally and it is very difficult to control the bed geometry to keep the navigable flow depth. The braided streams with narrow pass sections of the Ayeyarwady River, Myanmar as shown in Fig.1. Narrow pass sections can be formed often in braided rivers and are considered to affect the flow pattern and the navigable flow depth. In this study, braided streams formed in a straight channel with a stenosis (narrow pass) was reproduced experimentally and effects of narrow pass on navigable channel characteristics in braided stream are discussed.

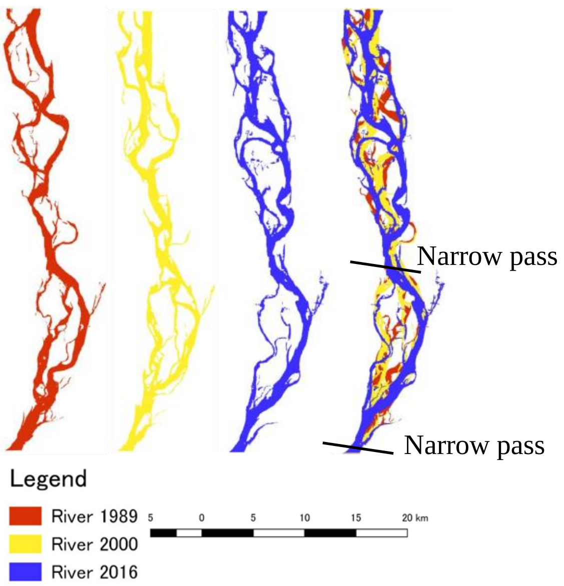

Fig.1.Channel configuration of the Ayeyarwady River

2. EXPERIMENTAL SET UP AND RESULTS

The rectangular straight open channel flume which is 20 m long and 50 cm wide is used. Two 10 cm x 10 cm timber posts are set at both sides of the flume at 9 m from downstream end as shown in Fig.2. Experiments, without narrow pass case (case 1), were conducted in advance of with narrow pass case (case 2) under the conditions of constant flow discharge and constant sediment feeding rate. The initial flume bed was filled smoothly with homogeneous anthracite, 0.65 mm in diameter and 1.45 in specific gravity. Bed elevation was measured with a laser instrument in the longitudinal direction of 10 cm interval at the target area (500-1300 cm from the downstream end).

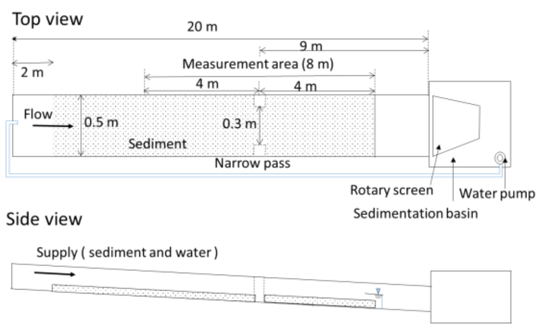

Fig.2. Experimental flume with narrow pass

Table 1 Hydraulic condition for experiments

Discharge (cm^3/s)	slope	*B/d*	*h/d*	τ_*
300	0.005	122.57	6.28	0.07

B: channel width, h: water depth, d: sediment size

The bed elevation contours for both cases after approaching an equilibrium condition of river bed are shown in Fig.3 and Fig.4, respectively. In case 1, channel geometry is unstable and change temporally well. Additionally, the difference of bed elevation between channel bed and bar crest is smaller. As a result, the flow depth tends to be shallower and it is difficult to keep the navigation flow depth. On the other hand, channel geometry is more stable in case 2. The difference of bed elevation between channel bed and bar crest is larger. As a result, the flow depth tends to be deeper and it is easier to keep the navigation flow depth.

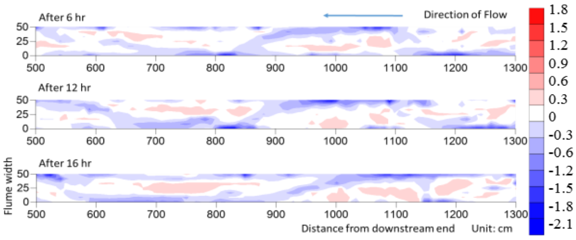

Fig.3. Bed elevation contour in case 1

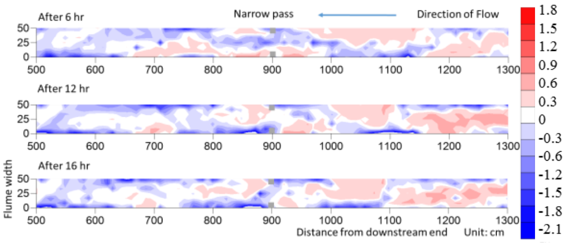

Fig.4. Bed elevation contour in case 2

3. NUMERICAL ANALYSIS AND RESULTS

Horizontal two dimensional flow calculation was conducted to evaluate horizontal distribution of water depth in the experimental flume to clarify the effect of narrow pass. According to discharge hydrograph of the river, computations are performed under 3 different discharge conditions with the same river bed. The bed geometry in both cases 1 and 2 after 6 hr from the experiment is used to check water depth in the small water discharge season.

The computed results on horizontal distribution of water depth and location of thalweg for both cases are shown in Fig.5 and Fig.6, respectively. Fig.7 shows longitudinal profile of water depth. In case 1, the water depth becomes zero from 500 cm to 600 cm in the case of the smallest discharge (25 cm^3/s). On the other hand, the water depth in case 2 is deeper than that in case1. Therefore, the deep water depth could keep easier for navigation on braided channel with the narrow pass and maintenance of fairway after some years.

4. CONCLUSION

In this study, effects of narrow pass on navigable channel characteristics in braided stream are discussed. Narrow pass make channel geometry more stable and the difference of bed elevation between channel bed and bar crest is larger. As a result, the flow depth tends to be deeper and it is easier to keep the navigation flow depth.

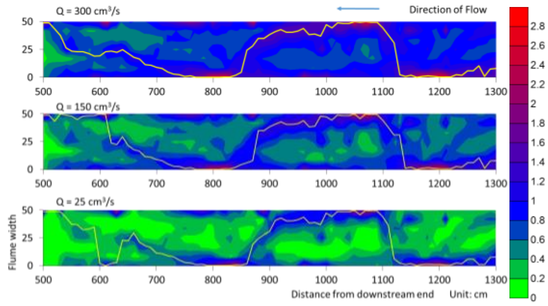

Fig.5. Horizontal distribution of water depth and location of thalweg in case 1

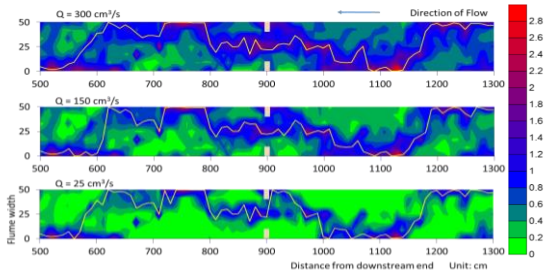

Fig.6. Horizontal distribution of water depth and location of thalweg in case 2

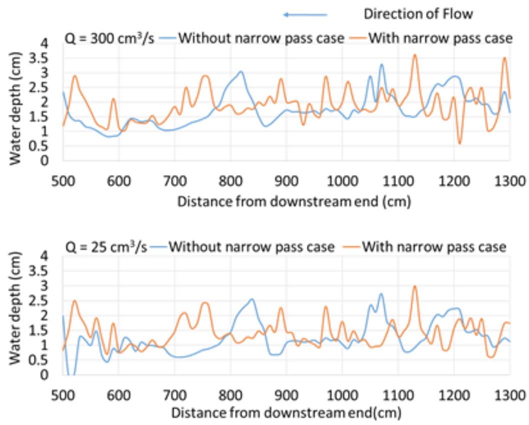

Fig.7. Longitudinal profile of water depth along thalweg

References:

(1)Takebayashi, H. (2005). River Configuration in Middle-Lower Reach of River Basin.

(2) Takebayashi, H, Egashira, S. and Okabe, T (2001). Stream formation process between confining banks of straight wide channels.