UNSTEADY FLOW ANALYSIS FOR THE DESIGN OF LOCAL SCOUR PROTECTION BY HEC-RAS(UNET) MODEL IN THE RIVER REACH AFFECTED BY TIDE

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The Han River is the largest river in Korea and flows through metropolitan Seoul from east to west. Because the Ilsan-bridge is located in the lower reach of the Han River, it is affected by tide from YELLOW SEA. The river bed material is mainly made up of sand and silt, and the turbidity is high, for which the river bed changes rapidly. It was 27th of October in 2004 during spring tide when the sheet piles were turned over because of the scour around them. The field observations were performed to get the velocity and water level. The time for flood tide is about 3 hours, and 9 hours for ebb tide. The backward velocity during flood tide is very fast and the forward velocity during ebb tide is relatively slow. There is an unusual phenomenon that the velocity is still negative for 10 to 30 minutes, while the water surface has already begun to fall. It might be because that the current-meter was installed at an elevation of -1.5m, for which it might detect the flow of the bottom layer in the section.

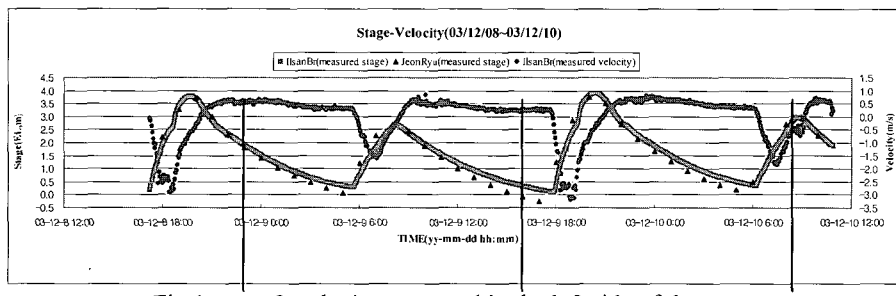
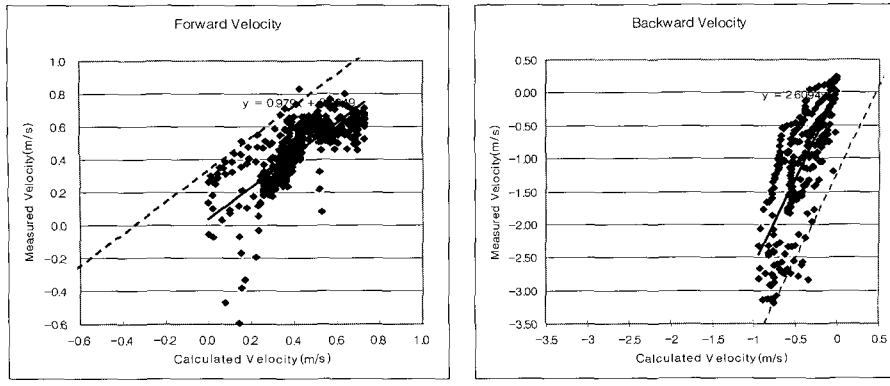


Fig.1 stage & velocity measured in the left side of the cross-section(2003/12/08~2003/12/10)

The numerical analysis was performed by HEC-RAS(UNET). The relationship between measured maximum velocity and calculated mean velocity is achieved.



(a) flow from upstream to downstream (b) flow from downstream to upstream

Fig.2 Comparison of calculated velocity with measured velocity

The regression equation of forward velocity is $y = 0.979x$, and the enveloped curve can be expressed as $y = 0.979x + 0.3349$, where y is the transformed velocity and x is the mean velocity from HEC-RAS. The regression equation of backward velocity is $y = 2.6099x$, and the enveloped curve can be expressed as $y = 2.6099x - 1.2$.

The embankment plan for CASE 1 makes relatively slow velocity and gives a reasonable diameter of riprap protection for construction, for which CASE 1 is selected for the plan.

Table.1 maximum velocity according to temporary road embankment plan

CASE	Embankment plan	Maximum mean velocity (m/s)	Transformed maximum local velocity (m/s)	Water level (EL, m)
1	MP20~MP24	-1.78	-5.84	3.36
2	MP17~MP24	-2.24	-7.05	3.29

Countermeasures for scour were designed with the results of the hydraulic analysis to avoid potential damage during construction work.

According to the results of monitoring, the velocity increase after temporary road embankment was negligible, from which it is considered that the degradation of main channel compensated for the constriction of cross-section by embankment.

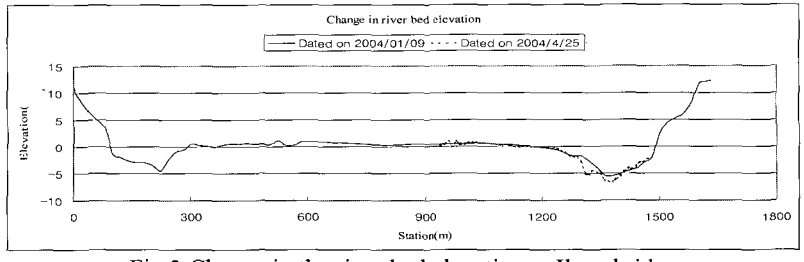


Fig.3 Change in the river bed elevation at Ilsan-bridge