

Development of New Techniques to Detect Destruction of Structures under the River

- Start of Invitation for New Technology Development -

(Study period: FY2017 to FY2018)

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1. Issues on river crossing structures caused by river-bed degradation

In order to discharge the flood flow safely, bed protective works that dissipate the downstream flow and prevent bed scouring are constructed in river crossing structures such as weirs. In recent years, river-bed degradation is proceeding in many rivers due mainly to the reduced supply of sediment from the upstream. For bed protective blocks, a structure with followability is adopted in the early design phase considering a certain level of degradation. If deformation of the bed protective works due to river-bed degradation exceeds the expected level, bed scouring in the downstream (Photo) or water route fixation will occur due to insufficient energy dissipation of flood flow or biased flow direction. In addition, there are not a few cases where the main body of the structure and peripheral structures such as weirs and bridges may suffer damage from local scouring. Actually, there is a report on a case of incident where the levee suffered damage resulting from damage to the river-crossing structure. For life extension of structures, it is required to introduce adaptive management for structures as well to conduct maintenance strategically and prevent damage. Deformation of bed protective blocks often proceeds under the water, where visual inspection or access is difficult, and are difficult to inspect. In addition, there is a design method for estimating river-bed degradation in construction of a new structure, but no technique to perform adaptive management for river-bed degradation is established.

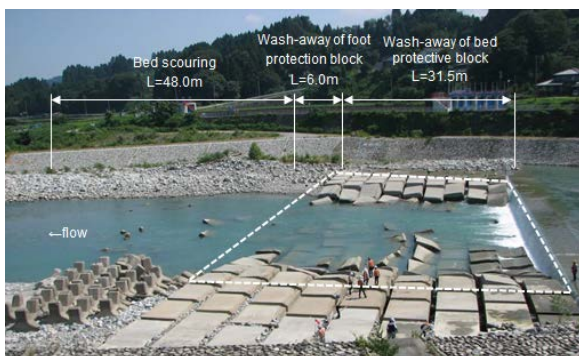


Photo: Example for wash-away of bed protective block in the downstream of the structure

2. Necessity to figure out destruction mechanism

When deformation of the structure proceeds, high-speed flow may generate at the bed protective works as shown in Figure, and the sediment under the blocks may be drawn out due to generation of negative pressure or piping, and then unevenness may occur and blocks may be washed away. Thus, destruction may rapidly proceed. There are a number of mechanisms considered for such destruction but it is not analyzed well at what stage the longitudinal section of the structure or progress in scouring in the downstream has the risk of destruction. In the future, it will be possible to determine the control level for adaptive management by figuring out the mechanism that controls the destruction phase where deformation rapidly proceeds in case of a flood.

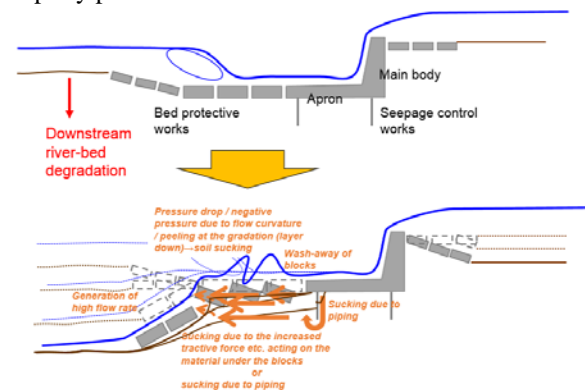


Figure: Destruction process of river-crossing structures

In order to solve the issues mentioned, NILIM started model experiments in fiscal 2017 and is inviting papers from the public on "Development of technologies for forecasting deterioration / damage / destruction of river-crossing structures in river bed degradation" in the invitation for research and development of erosion control technologies, and aims to prepare guidelines for adaptive management reflecting the results of these activities.

☞ See the following for details.

1) Start of the invitation for research and development of erosion control technologies (press release)
<http://www.nilim.go.jp/lab/bcg/kisya/journal/kisya20161201.pdf>