A Study on Channel Design Method Considering Disaster Mitigation

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1. Direction of river maintenance under the conditions of climate changes

Since climate changes are expected to increase flood frequency and water flow in future, it is required to take disaster mitigation measures that reduce damage as much as possible even in the event of a flood exceeding the capacity of countermeasure facilities or the planned scale. For disaster mitigation measures, focus is usually placed on what is called "non-structural measures," such as prior communication of the risk of flood disaster or proper provision of disaster prevention information at a disaster, but this study focuses on the following structural measures and verifies their effects. Then we intend to verify practical effectiveness of the measures and reflect them in channel and levee design.

- Measure I: River maintenance to secure lead time for evacuation, such as reducing flood flow in the event of levee failure or delaying the timing of levee failure
- Measure II: River maintenance to reduce peak discharge

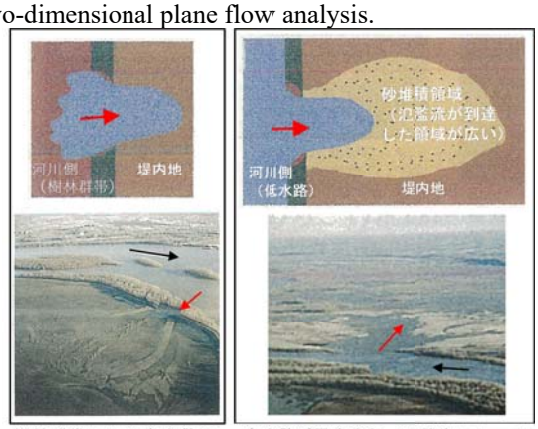
Examples and concepts are provided for Measures I and II, respectively, to introduce the contents of the study.

2. River maintenance to secure lead time for evacuation

Literature 1 shows that the degree of burst (amount of flood, extent of flood flow, etc.) is mitigated by the forest community zones along the levees as a result of studying burst cases at 67 spots in the US Mississippi River (Fig. 1). Literature 2 proposes what is called "crisis management type structural measures," such as protection of levee crest, etc. with asphalt and reinforcement of levee slope toe, etc. with blocks, as measures to prolong the time until burst as much as possible. This study is going to collect data on levee damage cases including not only cases resulting in burst but Hiyari-Hatto (near miss) incidents such as partial loss of levee, examine factors that affected the extent of damage as well as magnitude of the effect, and embody the river maintenance method for securing lead time for evacuation based on the detected factors.

3. River maintenance to reduce peak discharge

Flood control dams have holes in the body and reduce peak discharge in downstream channel by storing flood flow temporarily when flood flows in at a rate greater than the capacity of the holes. There is also topography having similar function in the river, e.g., narrow area, wide high-water channel, meandering, curve, and riverbed gradient changing points. However, it is not clear to what extent they are effective in reducing flow or what kind of flood flow they are effective. This study is going to clarify river topography that should remain in river maintenance by setting a lot of channels in different conditions including whether there is a narrow part, width and height of high-water channels, and curve shapes, operating a number of flood waves with different rising speed of flood, flood continuation duration, etc. and examining the effect of reduction in peak discharge in downstream channels by the two-dimensional plane flow analysis.



Relationship between channel conditions and burst situation (Addition to 1)
(Black arrow: Flow of the river, Red arrow: Flow of the flood)

☞See the following for details.

1) Ministry of Construction, Public Works Research Institute, River Department, River Division "Actual Status of Topographic Changes by Large-scale Levee Collapse," PWRI material, No. 3526, Oct. 1998

2) River Division "A Study for Devising the Structures of River Levee Crests / Slope Toes to Prolong the Time until Burst by Overtopping Even a Little," Technical Note of NILIM, No. 911, May 2016