Toward setting the frequency of weeding of levee required for flood control function maintenance

HATTORI Atsushi (Ph.D., Engineering), Head
FUKUHARA Naoki, Researcher
River Division, River Department

(keywords) levee, vegetation management, erosion, penetration

1. Issues in executing rational management

Weeding of river levee has a function to enable to get the situation of the surface of dike body on the occasion of visual inspection and assist to surely detect damages or deformations, and has an effect of maintaining yield strength of the slope against erosion and slide by preventing tall vegetation to grow and the surface to become soil. Weeding is carried out twice a year in principle in case of dikes under national control. It will possibly lead to further rationalization of maintenance if an appropriate frequency of weeding is set up in consideration of the flow rate and duration of action at flooding, the different dike structure and soil property, etc. for each section of dikes. Depending on the location, the frequency of weeding is forced to reduce, but in that case, it must be confirmed in advance that enough yield strength is maintained even if tall vegetation with the possibility of transitions grows. Although the knowledge about short vegetation represented by zoysia and cogon grass has been accumulated in terms of the effect to prevent erosion to what extent[1], the knowledge about tall vegetation represented by common reed and reed is not enough. Here is a technological issue which is a bottleneck to judge whether it is possible to rationalize management which evaluates yield strength and secures the prescribed flood control function as before, while allowing transitions of growing vegetation on the slope of dike from short vegetation to tall one.

2. Full-scale test using specimen obtained from the actual dikes

River Division conducted a hydraulic test to check the erosion resistance against flood flows and the stability against sliding rupture caused by penetration of rain falls, etc. with the cooperation of the head office of Ministry of Land, Infrastructure, Transport and Tourism and each Regional Development Bureau. The biggest feature of this test was that the test was conducted under simulated conditions of actual flood flows and rain falls by sampling in steel frames a part of the slope with growing vegetation from the actual dike just as it was, and bringing them into NILIM.

In the test concerning erosion resistance, the specifications of vegetation (growth density, plant's height and leaf area, etc.) were measured first and fall over height of vegetation and the flow rate near the ground surface reduced by vegetation and the progression rate of erosion, etc. were measured by providing the flow rate nearly equal to the one at actual floods. In addition, in the test concerning the stability against sliding rupture, coefficient of permeability (the degree of water penetration) by rhizome mixing in with the soil and the change of soil resistance were examined.

3. Obtained knowledge and its utilization

It was found that even under the situation covered by plants, if they were cleared by the flow rate near the ground surface, the progression rate of erosion has the similar relation with the bare ground not covered by plants. In other words, it was thought that the reduction of flow rate near the ground surface by stalks and leaves of plants was the mechanism to exert the erosion resistance of tall plants[(2)]. Furthermore, it was confirmed, comparing to the test, that the flow rate near the ground surface can be calculated using the hydraulic model which gives vegetation specifications and hydraulic conditions as parameters. Utilizing these observations, we propose a method to evaluate the possibility to prevent erosion against how much flow rate by organizing the calculation results of variable numbers such as kinds of plants, the height of plants and number of growing plants per unit area.

Rivers throughout the country have different hydraulic conditions, etc. according to the location. Therefore, by assembling the above outcomes, it will be possible to determine the place where the flood control function can be maintained with a reduced frequency of weeding or the place where the flood control function cannot be maintained without an increased frequency of weeding. It is scheduled to assemble the outcomes to be applied to in deciding an appropriate frequency of weeding at each location.

[References]

(1) UDA et.al.: Nature-oriented river dike protection works when flood flow occurs, cohesive soil and behavior of vegetation, Public Works Research Institute papers No. 3489, 1997
(2) Naoki FUKUHARA, Atsushi HATTORI : Test on special characteristics of erosion of river dike slopes where altherbosa grows, River Engineering journal Vol. 18, 2012