Application and Verification of Grass Concrete System in River Bank Protection

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This study has its objective in reviewing the hydraulic characteristics of Grass Concrete block in the river slope, which is developed for cast-in-place vegetation block system in order to improve the stability and maintenance against the high flood condition in comparison with pre-cast concrete block(H. Hewrett et al. [1]). Physical hydraulic model test was carried out at first and 1-dimensional numerical modeling with HEC-RAS and 2-dimension numerical modeling with RMA was adopted to compare the result of the hydraulic model experiment with numerical simulation results in terms of with vegetation or without vegetation; so that we can come up with a solution for the reduction effect in case of a flood. In the hydraulic model experiment, a river in Kyungsangbuk-do, Korea was applied to a scaled model, which discharge is supplied from a Sungduk Dam. Discharge in a laboratory supplied to the model by rectangular weir and water velocity and depth were measured to investigate flow pattern or hydraulic characteristics with or without vegetation in the artificial channel. The experiment discharges were 200 ㎥/sec, 100 year design flood, 400 m³/sec and 600 m³/sec, probabilistic maximum flood. 2 point method and 3 point method was used as measuring the flow velocity.

For the applied field's measurement verification, data of actual velocity and water stage were compared with the numerical simulation results in each section through the HEC-RAS (Hydrologic Engineering Center-River Analysis System). Also, through SMS (Surface water Modeling System), which is the 2-dimension flow analysis, flow pattern in the stream was examined with and without vegetation. Roughness coefficient is a main issue to calibrate the simulation model. The physical model was built as a scale of 1:50 by Froude similitude measuring the water levels and the water velocities with and without vegetation and the effects were analyzed after reviewing the results.

In consequence, the water velocities were observed to decrease meanly 19.1%, and the water depth were determined to increase meanly 27.8% in case of the of design flood, Q=200m³/sec. The results of the numerical simulation, under the condition of roughness coefficient calibration, show similar results of the physical modeling. These satisfactory results show that the accomplished results of hydraulic modeling and the predicted results of numerical modeling corresponded reasonably each others. This research will come in pretty handy in reinforcement of the current constructing close-to-nature rehabilitation as well as maintenance of the edge of the water and development of state-of-art numerical model being available to compute the tractive force, the resisting force of water flow on vegetation and the properties of flow of rivers is needed in further study.

KEYWORDS
Grass Concrete, hydraulic physical modeling, numerical modeling, roughness coefficient