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Urban flood management: on the optimal design of off-line detention basins

S. Segni Abawallo (1), L. Brandimarte (1), and M. Maglionico (2)

(1) UNESCO-IHE Delft, Institute for Water Education, Netherlands (l.brandimarte@unesco-ihe.org), (2) DICAM, University of Bologna, Italy

A detention basin is a structural measure used to manage floods by temporarily storing a fraction of the incoming water volume into selected areas. The design of the inlet and outlet structures is crucial for the optimal efficiency of the detention system. This research work investigates the sensitivity of flood attenuation, by means of an off-line detention basin, to the design characteristics of the inlet structures. The response of the attenuation efficiency is studied by varying the design characteristics of the different inlet components: elevation and length of the lateral weir and elevation, location and type of inline structure. The response of the detention basin to the different inlet layouts is evaluated by means of three performance criteria, two at the detention basin section and one at a downstream control section. Laboratory data available for the detention basin under implementation on the Navile channel (Italy) were used to calibrate a 1D numerical model in steady state conditions. The calibrated model was then used in simulating different inlet alternatives in unsteady state to determine the most influencing layout characteristics on attenuation. The results of this study can provide general guidelines for the design of the inlet structure of detention basins having similar structural components.