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Study on the Effect of Sediment Size on the River Dyke Breach Characteristics due to Flow overtopping

○Pawan Kumar BHATTARAI, Hajime NAKAGAWA, Kenji KAWAIKE, Hao ZHANG

In the past several years, the most commonly studied breaching parameter of dykes includes depth and breach width along with the breach side slopes or shape at final stage. Given the enormous damage potential regarding dike breaching, there is a need to understand the damage process of dikes in detail. This study is just preliminary one which supplements the next experiment with lateral overtopping dyke failure considering movable bed Systematic breach tests were conducted at the Ujigawa Open laboratory, Disaster Prevention Research Institute.

The flume is a horizontal channel 0.3 m wide, 0.3 m high and 8 m long and dike opening at the side of channel is also 0.3 m. The main hydraulic test conditions assumed include: 1) Trapezoidal shaped dike kept parallel to the river flow direction, 2) homogenous sediment, 3) 5 % moisture content by weight was added initially and compacted using similar procedure throughout the all experiments and no core layer added, 4) steady inflow with downstream gate control, 5) optical recording by video, high speed and three dimensional cameras. Flume discharge Qin = 7.89 l/s, dike height H = 0.15 m, dike length L = 0.3 m, dike crest width, b = 0.075m (0.5H), sediment size = No. 5, No.6, No. 7 and No. 8. The upstream and downstream dike slopes are Su = 1:2.5(V: H) Sd = 1:2(V: H) respectively.

For all the processes, initially, as the water overtops through pilot channel, the flow will erode not only the channel bottom but also the side banks of the incised channel. Immediately after the over-spilling from the pilot channel, the flow elongated downstream with the almost constant width. On reaching at the toe of the dam slope the flow gradually enlarged its width and by that time the failure of side banks of the channel had started. The side bank erosion is possibly generated, similar to bed erosion, by the shear stress created by the interstitial fluid. The recession of the side banks below the surface of the flow gives rise to the instability of the channel walls above and soon those parts will fall into the flow. But the processes have significant differences with respect to sediment sizes.

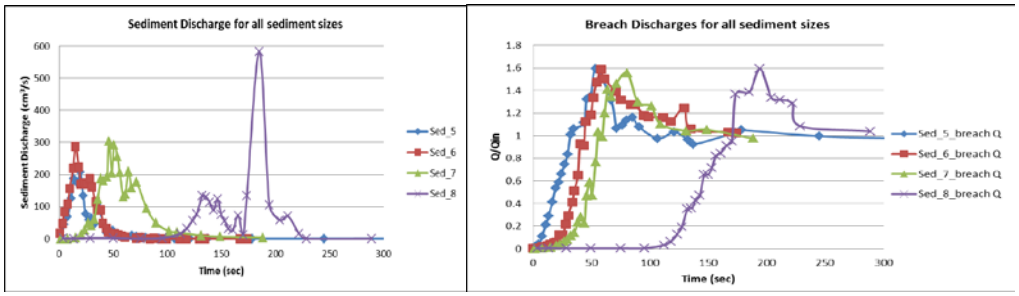

Fig: Sediment and Breach Discharges based on Sediment Sizes (Results from the Experiment)

Finally the numerical model is in the process of development based on the depth averaged two-dimensional momentum and continuity equation, a seepage flow model and a slope stability model . The results generated from the experiment include the lateral widening processes, breach flow discharges, sediment discharges and proposed curve for the prediction of the time of failure with respect to different sediment sizes.