

Laboratory Study about Bed Variation due to the Installation of Spur Dykes with Different Head Shapes

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Spur dyke is one of the main transverse hydraulic structures installed in the streams to prevent the bank erosion and improve navigation routes in rivers. Recently it is also used to provide better environment for the stream species which are in need of a diverse bed with various range of hydrodynamic, topographic and biologic conditions in rivers.

Based on the shapes of the spur dykes in the plan, different kinds of spur dykes can be recognized: “Straight shape or I-type”, “T-type”, “L-type” and etc. Spur dykes are rarely installed individually in the streams, but usually in series.

So far the considerable works have been dedicated to the study of the “single straight” shape spur dykes, mainly aimed at investigating the flow structures around them. On the other hand, there are some limited researches and knowledge about the study of sediment transport around spur dykes with different shapes of head, especially when they are arranged in a series. In 1964, Linder et al conducted a set of experiments to find the optimum combination of a series of L-shape spur dykes in a left bank of a reach of Missouri River in the U.S. In 2009, Vaghefi and Ghodsian studied flow field scouring around a single T-shape spur dyke in a 90 degree bend. In 2010, Kadota et. al. conducted a series of experiments in which they studied hydrodynamic of flow around an individual T and L- shape spur dykes.

To sum up, so far the researches about spur dykes have mainly focused on the study of straight spur dykes and even in the few researches about other

shapes of spur dykes, the most cases were individual spur dyke (not series). In other word, there is still an extensive debate on how to optimize the spur dyke shape and their spacing in a series of spur dykes in order to increase their functionality specifically when it is needed to design nature-friendly spur dykes and to improve the bio-diversity of living environment of riverine biota and fauna by applying this kind of hydraulic structures inside the streams.

In this study, the formation of scour hole around two types of spur dykes with different shapes of head was investigated using experimental works. Two case studies were considered: a simple series of straight spur dykes and a simple series of spur dykes with T-head shape. The equilibrium of bed variation in both spur dykes was shown and the differences and similarities of the pattern of scour hole were investigated. Finally, an in-depth discussion about the formation of the scour hole and the deposition area around these types of spur dykes was studied in order to evaluate the performance of the special geometrical features of T-head shape spur dykes (its wing) to the formation and extension of scour hole toward the downstream.

The importance of this study can be highlighted regarding the fact that controlling bank erosion, better navigation and/or improving biodiversity are being directly affected by the shapes of these structures and accordingly on the basis of the primary objectives of the application of spur dykes, using a series of T-type would be an advantage compared to common designs.