ASSESSMENT OF THE EFFECT OF STABILIZATION WORKS AT THE RIVER CONFLUENCE DESAGUADERO -JACHJAHUIRA, BOLIVIA

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One of the most complex and challenging processes in river engineering is the confluence of river branches, where sedimentation, erosion and backwater effects can be the origin of many problems in the immediate surrounding of the confluence. Some of the aforementioned problems are present at the confluence of the rivers Desaguadero and Jachajahuira, located 85-Km southwest of the city of La Paz, Bolivia.

The river Jachjahuira discharges in the river Desaguadero at an angle of nearly 90° resulting in a drastic reduction of the flow velocity and a massive sedimentation of silt, causing morphological instability of the main river. In a physical model (LHUMSS, 2001) the effect of the following stabilization works was examined: (a) a meander cut-off and trajectory modification to obtain a new conjunction angle; (b) the implementation of ten submerged vane arrays and four double-sided weirs across the main river; and (c) the implementation of Reno mattresses for additional river bank protection. Since in the physical model the sediment transport and the morphodynamic behavior of the river in the study zone was not taken into consideration, observations in the laboratory study were combined with the mathematical model (DELFT3D), in which the processes neglected in the physical model are considered.

The model was calibrated by means of a number of scenarios, consisting in morphologic and hydrodynamic simulations for different periods of time as recommended in STOWA/RIZA (1999) and Baptist et al. (2002). The assessment of the accuracy of the new generated bed topography was done by means of the comparison between the observed and calculated bed elevations in the nodes of the generated mesh and the superposition of the existing and the generated terrain maps. For this calibration scenario, values of the Medium Error = 0.10 m, Average Error = 0.22 m and Absolute Percentage Error = 15.61 % were obtained, and a value of $R^2 = 0.7218$. The model was satisfactorily validated comparing the observed flow patterns (discharge, flow velocity and water depth) in the physical and mathematical model.

The effect of the proposed stabilization works was assessed by means of a Medium-Term Morphological model for a simulation period of 20 years. The model outputs were bathymetric reliefs for the 2000-2020 time period (see Fig. 1) and a number of cross sections illustrating the morphologic changes during this interval. The results showed that for the given prediction period, the aforementioned angle and the double-sided weir contribute to the morpho-dynamic stability of the zone, reducing bars formation (in

average 0.5 m in 20 years), orienting the velocity field towards the center of the river and reducing the impact on river bank erosion and sedimentation processes. The configuration of the model did not allow the correct simulation of the behavior of the submerged vane arrays; hence, their impact could not be assessed properly.

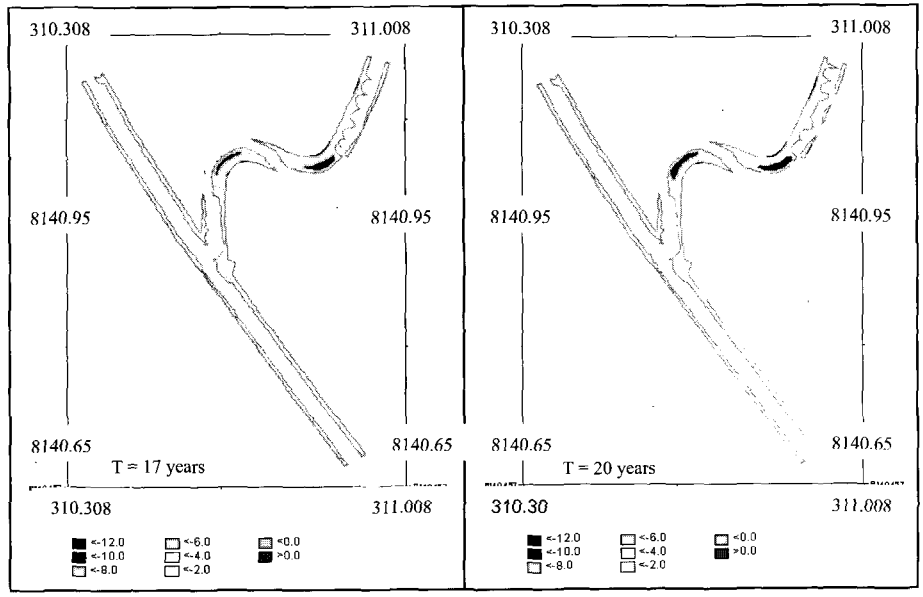

Fig. 1 Bathymetric reliefs generated by DELFT3D for years 17 and 20 in the period 2000-2020

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