Hydraulický výzkum rekonstrukce dráhy pro vodní slalom v Ivrea, Itálie

Hydraulic investigations of the water slalom course in Ivrea, Italy

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Klíčová slova

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Key words

Water structures – hydraulics – physical and numerical modeling – 3D model

Abstract

The recent increased interest in whitewater sport, mainly caused by the inclusion of the Canoe Slalom to the Olympic Games program leads to the higher numbers of both new and reconstruction projects in this field all over the world. The aim of this paper is to describe a new approach in water slalom course modeling. The current state course no longer suits the needs of the competitors and athletes and it was decided that should undergo a reconstruction to make it more interesting for the competitors but also use the current geometry as much as possible. The course is located in city Ivrea, Italy and the length of the course is approximately 230m. Nevertheless only the last 125m were chosen to be modified. The parameters of the course had to be changed and thus it was decided to build a physical model in scale 1:17 in a lab where all the changes could be made easily and effectively. For the best accuracy, the geometry of the course was obtained using laser scanning. This method eventually created a point cloud of more than 400 000 points including x,y,z coordinates. Also classic geodetic survey was made to extend the laser scanned area. Using 3D and meshing transformation tools the point cloud and the survey data were merged and modified into a complete 3D surface that perfectly reflected the current state of the course including all detailed geometry. That is important because every slight difference on the scaled model can create a big difference on actual course. Afterwards, the 3D surface was used to build a physical using 3D milling technique. Thanks to the precise head of the milling machine, all the details could have been preserved. At the end of the process 3 blocks were milled, together creating 7,5m long, 1,2m wide and 20cm thick model of the course. The material used for the milling were RAKU TOOL blocks that provide good surface properties compared to those in the actual course. Then the hydraulic support wooden structure including water inlet and outlet was made in order to begin with designing the new shape of the course. To alternate the existing water obstacles and geometry the best option was to use clay. After redesigning the course the velocity and depth in key points on the model were measured and those values were transferred back to the computer model. Based on those data a map with basic water phenomenon was created along with the updated computer model. Also a slow motion video was made where the reality flow and the modeled one could be compared at the same

speed. That allows to perfectly see the difference in the flow on the changed geometry. That 3D model with the map then became a foundation for reconstruction project documentation.

Anotace

Pro potřeby hydraulického výzkumu projektu rekonstrukce dráhy v italském městě Ivrea byl nově použit přístup laserového skenování terénu s následným přenesením do 3D modelu a tvorbou fyzikálního modelu v měřítku 1:17 metodou 3D frézování.

Annotation

For the purposes of hydraulic research on the reconstruction project of water slalom course in Ivrea in Italy a new approach was developed where the current state of the course was projected to the computer 3D model using laser scanning followed by creating a physical model in 1:17 scale by 3D milling.