

The Rhone River upstream of Lake Geneva - HEC-RAS numerical model and ArcView® database (2002)

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Study entrusted by the "Service des routes et des cours d'eau" of the Canton of Valais for the 3rd Rhone correction

Introduction

Following the floods of 1987, 1993 and 2000, the canton of Valais became aware of the deficiencies of the present protection measures of the Rhone River and decided to implement the 3rd Rhone correction between Martigny and Brig. The project will later be extended to cover the complete river down to Lake Geneva. One of the objectives of the correction of the river is to optimise its hydraulic capacity.

During past studies, the authorities noticed the difficulty in working with the existing Rhone River data, particularly with regards to the availability and the identification of the river cross sections.

In this context, in November 2001, the LCH was mandated to collect all available geometrical data and to prepare a geo-referenced database necessary to build a single digital 1D model of the Rhone River from Lake Geneva to Brig.

New river station mileage

One of the principal tasks of the study was to determine the mileage of the Rhone River cross sections. In fact, seven river reaches have been identified between Lavey and Brig, each one having its own catalogue of cross sections. On the basis of the cross sectional data, all available in a geo-referenced system, the distances between successive profiles were calculated to establish the mileage associated with each cross section, starting from the origin located at the mouth of the Rhone. As a result the overall length of the Rhone River defined between Lake Geneva and Brig is 118.610 km (Fig. 1).

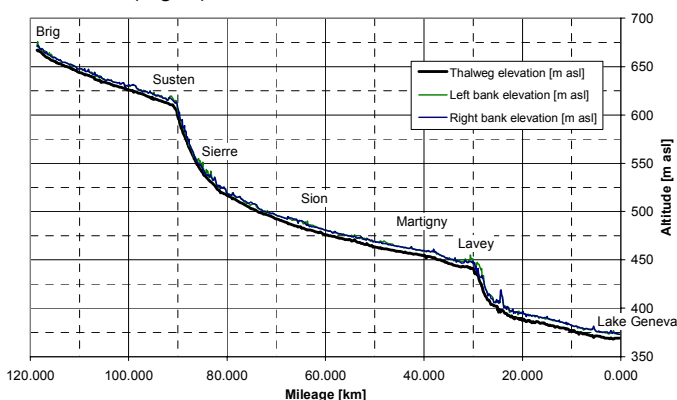


Fig. 1: Stream profile of the Rhone with some reference localities

In the future, the new mileage will be used as a single labelling of the Rhone cross sections between Lake Geneva and Brig. It will allow the putting in place of mileage plates along the embankments of the Rhone in the Valais.

HEC-RAS numerical model

The full 1D digital model was built on the basis of the most recent topographic surveys and calibrated with the existing observed flood marks of the October 2000 flood (Fig. 2).

Thereafter, the water surface elevations for the project flood discharges defined for the 3rd Rhone correction were calculated.

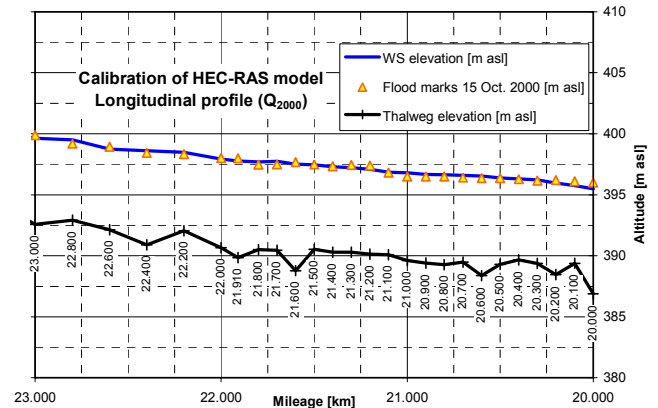


Fig. 2: Calculated water level in the calibrated HEC-RAS model with flood marks from october 2000

ArcView® database

The national co-ordinates of the left and right banks and of the thalweg as well as the future mileage label of the cross sections were integrated for illustration into the ArcView® database (Fig. 3).

The interface's background consists of the topographic maps at a scale of 1:25'000. They allow the identification of all the river related data with regard to the terrain. The database was completed with the integration of approximately 80 photographs showing the Rhone River between Lake Geneva and Brig.

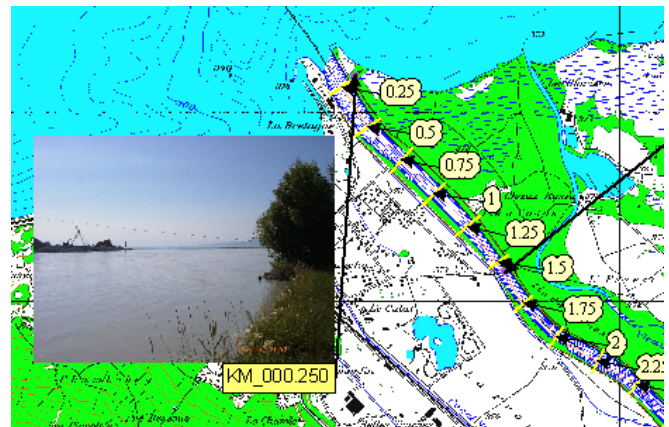


Fig. 3: ArcView® interface on a topographic map background with identification of cross sections and photographs of the Rhone

Conclusions

The 3rd Rhone correction is a large-scale national project. It must rely on solid fundamental bases. The analysis of the existing situation showed not only the deficiency regarding flood protection but also the absence of clear and univocal references on the existing river geometry.

The presented study provides a digital 1D model between Lake Geneva and Brig, calibrated with regard to observations made after the October 2000 flood. Moreover it contains an ArcView® database including more than 600 cross sections, as well as a photographic documentation with some 80 pictures. This information is completed by the simulation results of the passage of the HQ₁₀₀ cible project flood defined for the 3rd Rhone correction.