

## COMPARISON OF DIFFERENT MEASURING METHODS FOR POSITIONING OF A RECORDING DEVICE IN LARGE MODELS

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### Introduction



Within the framework of the Integrated River Engineering Project a hydraulic model with a movable bed was constructed for the analysis of the Austrian Danube section east to Vienna. On this occasion different systems and methods for measuring lengths had been compared, in order to implement an optimised system in the course of the aforementioned project.

The horizontal measures of the simulation model were 50m x 16m. An additional requirement was, that a one meter difference in height can vertically be measured at every point of the coordinate system.

The geometric ranges of tolerance and the required measuring frequencies were pre-determined. Additionally the basic conditions, due to implementation in a continuing test operation, and the constructive and economic pre-requisites needed to be taken into account.

Based on the determination of the position of the recording device, the mechanic control should then be coupled with the positioning system in order to be able to control the device automatically and online in the test.

### Selection Criteria of the Measuring Systems

- accuracy in measuring horizontally: 1 cm
- accuracy in measuring vertically: 1 mm
- Repetition rate: < 1Hz
- Simultaneous control of recording device (online measuring)
- consideration of vibrations and potential deflexion of the measuring bridge
- contamination sand, local fluctuations in humidity, water reflections should not affect the measuring

### Description of Different Systems



Three measuring methods have been analysed:

#### Electric measuring of length

The background of electric measuring of length, allegorises a transformation of distance into capacity, inductivity, resistance et cetera. The signal processing in this method can be divided into:

- **Analogue gathering of values** - the measured values are converted into an electric signal and amplified. Depending on the system, the collecting of values can be done in a tactile, or non-tactile measuring process.
- **Digital gathering of values** - the measured values recorded incrementally are assigned to a signal. The original value is a digital signal, a sum of counts.

#### Optic measuring of length - interferometric measuring

If two beams of light are superimposed, light interferes in the form of periodic fluctuations in brightness. This can be monitored, if both waves are moved towards each other. The number of occurring interferences multiplied with the wave length of the light, equals the relative displacement.

#### Opto-electronic measuring of length - triangulation method

The principle of this method is based on the use of a distance meter and a reflector. The distance meter sends out a visible or infrared light which is received by the distance meter. Thereby the delay of the signal is measured and the demanded length can be calculated.

### Choice of the Measuring System

Based on the theoretic approaches of the measuring methods as well as the economic reasons a system was developed, which combines the advantages of a guide rail construction with an opto-electric length measuring system. The Institute of Production Engineering (VUT) was in charge of the realisation.

Several triangulating laser measuring probes (triangulation methods) are used for length measuring systems. Due to this development it is possible to move the measuring device on every trajectory and to choose almost any velocity. The resulting measuring accuracy horizontally is  $\pm 2$  mm and vertically  $\pm 0,5$  mm.