Investigation of Different Approaches for Vibration Monitoring of Bridges

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ABSTRACT:

Structural failures like the I-35W Mississippi River Bridge collapse on the first of August in 2007 is besides a huge economic loss often associated with personal suffering and underlines yet again how quickly existing inspection and monitoring methods may fail. Engineering geodesy has always been providing an important contribution to the monitoring and deformation analysis of man-made structures. However, these are often restricted to static analysis of the geometric shape. The dynamic characteristic of a structure was not often taken into consideration. Admittedly the vibration analysis of structures has increasingly become part of the engineering geodesy and thus contributes more detailed information about the capacity and condition of structures. In this contribution the potential and limitations of different sensors for vibration and geometric deformation analysis will be presented on a real problem. Therefore a suitable sensor setup was determined and measurements have been carried out with an accelerometer (see Fig. 1), GPS and a laser tracker. In addition displacements of the bridge were observed with the IBIS-S system. The IBIS-S is based on the principle of microwave interferometry with accuracy down to the sub-millimetre and a sampling frequency of 100 Hz. This enables the possibility to determine real-time deformations of the bridge. Finally the data has been analysed in terms of natural frequencies, mode shapes and damping parameters and compared. The natural frequencies for each station along a bridge can be combined in one 2D contour plot, as shown in Fig. 1.