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Geophysical survey and diagnostic monitoring of the water main Zelivka in Czech Republic

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Water main Zelivka is 52 km long tunnel with 2.6 m diameter, connecting dam Svihov and nearby water treatment plant with the reservoir in Vestec at Prague. It has been operating for almost 40 years without any technical break and or longer maintanance shutdown. Water main Zelivka is the Prague main supply of drinking water covering over 75% of its consumption.

In 2007 the 9 km long part of a tunnel was inspected. During 2 short shutdowns(lasting less than 24 hours) a photo and video documentation, measurement of geometric parameters and complex diagnostic survey were taken. Also a complex geophysical survey along the tunnel route was carried from the surface.

Among others, the GPR measurements played the important role in concrete tunnel wall and surrounding rock massive state evaluation. A special multichannel trolley had been designed and constructed specially for this project.

Complex analysis of results from different diagnostic and geophysical methods helped not only to evaluate the actual state of the water main and to detect existing defects, but also to determine main negative factors influencing on the tunnel structure.

The introductory phase of a survey was followed in 2009 by the detailed survey of selected tunnel interval with detected defects. 40 m long interval of a tunnel wall was surveyed in the grid of radial GPR lines with 0.5 m separation. During the same short break the diagnostic monitoring system consisted of deformation, temperature and pressure measurement sensors was installed.

The long term automated monitoring of the crack displacement and water pressure has been taken since with the aim to find the empirical relations between the wall strain and the dynamic changes in water main mode (the water flow in the main is changing from 3 up to 7 cubic meters per second depending on water demand). Measurements have been taken hourly and collected in data-logger and transmitted every 24 hours.