

Geophysical Support of Geodynamical Studies of the Surroundings of Large Engineering Objects

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Key words:

SUMMARY

The paper presents contribution of geophysical methods (shallow seismic sounding and electro-resistance profiling) to geodetic studies of recent tectonic movements of the area on which large engineering objects have been located. The presented approach is illustrated by the study-case of the dam and artificial lake on Dunajec-river, Pieniny Klippen Belt, Southern Poland, Polish/Slovak border. The Klippen Belt is a tectonic formation separating the outer from the inner Carpathians. The Polish part of the Klippen Belt forms a mountains group called the Pieniny Mountains. Geodynamical studies of the area were performed continuously from early sixties until 1995. Diversified vertical motion (on the level of some mm/year) and horizontal displacements (reaching 10 mm/year) were proved. As construction of the dam on Dunajec-river and creation of the artificial lake might contribute significantly recent crustal activity of the area, in the period of 2001-2003 geodynamic studies of the Pieniny klippen belt have been resumed. Geodetic methods (terrestrial and satellite) and geophysical methods (gravimetric, seismic sounding, electric resistance profiling) have been applied. The results were compared with those obtained earlier in the years 1970-80-95 in the same region by the Institutes of the Warsaw University of Technology. The aim of project was to find how the construction of the dam on Dunajec-river and creation of the artificial lake have influenced recent activity of the region. Results of precise leveling and trigonometric leveling have proved significant (6-7 mm) vertical depression of the PKB relating adjacent tectonic units: Magura nape (in North) and Podhale fliś (in South). Horizontal movements between the control points monitored by laser-distance and satellite GPS measurements have demonstrated shortening at the northern contact of the PKB and differentiated extension trend at the southern contact. The character of the motion corresponds with changes in the seismic wave velocities: increasing in the region of the northern contact and decreasing in the southern contact comparing with those of 1988. Such a behavior can be explained by the increase and decrease of the stresses in the basement resulting probably from the water loading of the artificial lake. Gravimetric measurements have shown inessential increase of gravity in the region of the PKB. The results of geodynamic studies have proved recent activity of the area considerable enough to take it into account in the process of forecasting safety of the dam in Niedzica and the Czorsztyn Lake.

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