



Technical Information

GRAVITY MEASUREMENTS FOR CAVITY DETECTION

part of a geotechnical study for a subdivision development
Project in Eastern Slovakia, 1993.

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The gravity investigation described in this document was undertaken to detect an underground cavity suspected to have been caused by the movement of ground-water under a concrete slab pavement. The depth of the cavity was expected to be approximately 2 to 3 meters below surface. The size of the cavity was not known prior to the gravity investigation, however, it was expected that the cavity would be partially filled with water.

A Scintrex CG-3 "AUTOGRAV, a fully automated gravity meter, was used for the investigation. The CG-3 "AUTOGRAV is equipped with solid state memory, so that readings may be recorded along with the X and Y coordinates of the survey station and the time of the measurement. The built-in software applies various corrections, such as tide, tilt, temperature and drift corrections, to the gravity values at the time of the measurement. The reading errors that are common to other gravity meters - due to optical parallax, operator's judgement etc., are eliminated by the fully automatic measurement and the continuous averaging of a series one-second samples. The CG-3 displays and records the statistical error of each reading for future reference.

The survey parameters/logistics of this gravity investigation were:

station interval - 1 metre, line interval - 1 metre
total dimensions of site to be surveyed - 22 meters x 6 meters

The X and Y coordinates for each station were established with a chain to an accuracy of +/- 10 cm. The elevation of each station was surveyed using a theodolite to an accuracy of 1 cm. The measured values were corrected only for the vertical gradient. Other corrections, such as topographic corrections, were not applied because of the nature of the project and the very limited extent of the investigation area. The final gravity data set was corrected for the regional trend of the gravity field. The geophysical responses were processed using various modelling programmes with the objective of incorporating all known parameters (such as densities of the top layer and sub-surface material) to further improve the interpretation of the results. The cavity produced a negative anomaly of up to 0.03 milligals (30 microgals) below the local background. Based on the results of this gravity investigation it was possible to interpret the location and lateral extent of the cavity.

The results of the investigation and interpretation were confirmed by six boreholes that were later drilled. These boreholes were also used to inject concrete to fill the cavity. This case history proves the usefulness of geophysical investigations prior to using other geotechnical methods as a cost effective way to solve problems in civil engineering.



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