National Report of Lithuania on Establishment of National Geodetic Vertical Network

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The main geodetic activities of Lithuania since 1998 were related to the establishment of National Geodetic Vertical Network. The aim of the Lithuanian NGVN establishment is the determination of geopotential heights of the points and creation of height reference network for the country. The NGVN should implement unified system of heights in the territory of Lithuania and guarantee reliable connection with other European height systems. NGVN should be continuously updated for the purpose of heights and their accuracy determination.



Fig 1. Project of the National Geodetic Vertical Network

The NGVN is composed of two orders. First order of NGVN consists of 5 polygons of precise levelling lines. Most of the lines coincide with the existing levelling lines and run through the points of National GPS Network and National Gravity Network. Precise levelling of fifth polygon was finished in 1999 (Fig 1). Length of levelling line is 499.9 km (515.6 km including lines to Polish boarder and reference benchmark in Kaunas). It should be stated that perimeter of the whole network is ca. 1900 km. Digital

levels Leica NA 3003 and bar coded staffs Wild GPCL-3 were used (We are grateful to the Finnish Geodetic Institute for the levelling staffs calibration). Average number of stations in one km was 19. Average line of sight was 26m, maximal -35m. Mean distance between benchmarks was 1.4 km. Temperature of staff's invar strip was measured at 1 and 2 metre height by contact thermometers. Influence of refraction was reduced by covering 50 centimetres of lower staff part by non-transparent material. Correction

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of staffs calibration, temperature variations, refraction, Moon, Sun and normal corrections were introduced. Misclosure of the fifth polygon levelling was 10.65mm (allowable -22.4 mm).

By comparing latest precise levelling data with previous precise levellings, it was determined that differences are higher than errors of observations, therefore some conclusions about geodynamic processes in the region will be worked out.

Reconnaissance of the existing benchmarks of the second polygon was performed during autumn of 1999 and spring of 2000. All necessary new benchmarks were built. Reconnaissance of second and fifth polygons showed a poor picture – that less than 40% of ground and wall benchmarks of previous levellings could be found or used for a new precise levelling. Every ground benchmark of the second polygon was coordinated by GPS (proportion of ground and wall benchmarks number is almost 50:50).

Lithuanian National Gravity Network was established in 1998. It provides a reference for Lithuanian gravity data evaluation and for working out project of Lithuanian National First Order Gravity Network.

Network is based on three absolute gravity points: Vilnius, Panevėžys, Klaipėda. There is 51 gravity point in the National First Order Gravity Network of Lithuania. Totally 98 baselines were projected. There are minor changes if compared to the network observed in the 1998, only points located too dense or in locations inconvenient to reach by car were eliminated.

Observations of National First Order Gravity Network were performed together with specialists of Polish Institute of Geodesy and Cartography as well as gravity observations for determination of the relation between absolute gravity points in Poland and Lithuania and for clearing out errors of used ballistic gravimeters. Three gravimeters La Coste & Romberg were kindly provided by Polish colleagues. Gravimeters were calibrated in Poland at absolute gravity points. Every baseline of National First Order Gravity Network was measured three times. Two baselines were measured everyday. 40 baselines were measured during the 1999. Corrections of calibration and corrections for Moon-Sun influence were applied. Rms error of gravity value of measured baseline does not exceed 25 mgal. A new catalogue of National First Order Gravity Network points was created.

Some magnetic field observations were performed during 1999. Six points for magnetic field observations were selected. Specialists of Polish Institute of Geodesy and Cartography and Institute of Geodesy, VGTU performed magnetic field observations. Instruments used for measurements were proton magnetometer PMP-5a, antimagnetic theodolite Zeiss Theo 010 B and magnetometer Fluxgate MAG01K. Observatory of Belsk (Poland) was taken as the reference for magnetic field observations. Declination of magnetic field, inclination and vector of intensity were determined. Magnetic field parameters were reduced to the epoch 1999.5. Differences of magnetic declination comparing to Soviet and NATO maps were determined. Magnetic field observations will be repeated for determination of its parameters' variations.

It was planned that establishment of NVGN will be finished in 5 years. Due to the recent economical problems this plan seems to be too optimistic.

Reference

 Establishment of National Geodetic Vertical Network of Lithuania. Scientific report. Institute of Geodesy, VGTU, 2000 (In Lithuanian).