Readjustment of the fundamental leveling network in Poland in EVRF2007-NH European Vertical Reference Frame

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INTRODUCTION

KRONSZTADT’86 is previous and continuously valid in Poland vertical reference system, which has been connected to tide gauge in Kronsztadt (Russia).

The main purpose of the readjustment of the Polish fundamental levelling network was to define heights of the points in common European Vertical Reference Frame EVRF2007-NH with connection to the Normaal Amsterdams Peil (NAP).

In processing were included new levelling measurements and multifunctional points determined from GNSS observations and precise levelling.

Additionally, the method of the connection to the reference frame was changed. New readjustment was connected to the EUVN and EUVN_DA reference points.
INPUT DATA

1. Adjustment of the European vertical network EVRF2007-NH (M. Sacher, et all). From Poland in common adjustment 16 071 benchmarks were used.

2. Archive data for first and second class of the precise national levelling network in Kronsztadt’86 vertical system

3. Multifunctional points determined from GNSS observations and precise levelling.

4. Updated second class levelling lines.
Old first class levelling network consist of 517 lines (382 main lines and 137 lateral) with 16225 benchmarks.

The shortest line was 0.7km and longest one was 107.41km, (mean length of the I class lines was 45.85km.)
Second class levelling network consist of 2,601 lines (2,561 main lines and 40 lateral) with 25,484 benchmarks.

The shortest line was 57m and longest one was 70.3km, (mean length of the II class lines was 14km.)
In first step existing data were adjusted in Kronsztadt’86 for analysis of consistency and correctness of the data.

**FIRST CLASS**

One benchmark was fixed. RMS of the first class benchmark height was ±0.00739m. Maximum value was ±0.01145m. RMS of 1 km levelling was $m_0 = ±0.00089m$

**SECOND CLASS**

In adjustment of the second class levelling 1478 benchmarks were fixed. RMS of the second class benchmark height was ±0.00325m. Maximum value was ±0.00939m. RMS of 1 km levelling was $m_0 = ±0.00141m$


The new fundamental network consists of 342 lines with 14413 benchmarks:

- 14343 benchmarks,
- 71 ground eccentricities of the ASG-EUPOS permanent stations.

Connection to the EVRF2007-NH were realized by 49 EUVN and EUVN_DA points.

RMS of the first order benchmark height was ±0.00355m. Maximum value was ±0.00748m.

RMS of 1 km levelling was $m_0 = \pm 0.00074m$. 
NEW ADJUSTMENT (2)

• **BASE NETWORK – SECOND ORDER**
  The new base network consist of 2191 lines with 25 599 benchmarks:
  – 25 533 benchmarks,
  – 37 ground eccentricities of the ASG-EUPOS permanent stations.

Connection to the Fundamental network (first order) were realized by 1175 benchmarks.

RMS of the second order benchmark height was ±0.00356m. Maximum value was ±0.00962m.

RMS of 1 km levelling was $m_0 = \pm 0.00145m$
Comparison of the benchmarks heights of new adjustment in EVRF-2007 with old Kronsztadt '86.
Comparison of the benchmarks height of new adjustment in EVRF-2007-NH with old - Kronsztadt '86 (after transformation)
CONCLUSIONS

- New adjustment connects Polish vertical network to the European vertical system EVRF-2007-NH
- New adjustment slightly improve accuracy of the benchmarks height
- New EVRF-2007-NH vertical reference system is most actual for Poland territory
THANK YOU