SOME ASPECTS REGARDING THE USE OF GNSS TECHNOLOGY IN THE GENERAL CADASTRE WORKS IN ROMANIA

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Abstract:

Is the use of GNSS technology in general cadastral works in Romania, in areas where this technology must take into account some aspects regarding the reception signals and the use of a measuring RTK that is otherwise agreed by ANCPI with some clarifications.

Accuracy and issues that have to be respected in raising cadastral in Romania and in general cadastre are presented in this work and here presents ways that can fulfill the requirements, the Director ANCPI Order 700 as amended and the Law. 7/96.

Finally, the conclusions drawn from the use of GNSS technology in cadastral elevations for the general cadastre are complied with, in compliance with the rules in force.

INTRODUCTION

The present paper introduces the legislative framework regarding the general cadastre works, normative acts and the use of GNSS technology in the areas where this technology has to take into account some aspects regarding the reception of the signals and the use of the measurement method RTK, which is also agreed by the ANCPI, but with some clarification on the use of GNSS technology for the support and lifting networks.

The legislative framework in the field of cadastre in Romania was and is ensured by the basic laws no. 18/91 (Land Fund Law) and 7/96 (Law on Cadastre and Real Estate Advertising), modified in time by Government Decisions, Ministerial orders and the National Agency for Cadastre and Real Estate Advertising, all frequently amended and republished. The institutional and organizational framework is also well defined by current legislation and rules. The National Agency for Cadastre and Real Estate Advertising (ANCPI) is the only central authority in the field, doubled by OCPI at county level.

Other normative acts to which reference is made, should be remembered for their importance and timeliness as follows:

- Regulation on the approval, receipt and registration in the actual cadastral register and land records, introduced by Order 700 / July 2014 and amended by Order 1340 of December 2015;

-The National Cadastre and Land Book Program of the National Agency for Cadastre and Real Estate Advertising for the period 2015-2020.

The precision and aspects to be observed in the general cadastre works in Romania are reviewed in this paper.

WORK METOHDS

The technical project for the execution of works**.** The technical project, drawn up on the map at 1: 25000 scale, is finalized after recognition of the existing geodetic network points on the ground. Multiple points in the geodetic network are spatially determined by satellite methods and then new points are determined for the support network. For the lifting network, a number of points were designed according to the customer's requirements and the technical norms and according to the land on which the cadastral elevations are wet, after determining the support network.

When selecting the locations of these points, consider:

- new points should be located next to easily accessible roads throughout the year;
- the points should be located close to the objectives to be raised topographically, considering that a lot of dwellings, residential neighborhoods, access roads, etc. will be built in the area.
- to avoid material obstacles, high voltage lines or transformer electrical stations near the receivers (elevation angle> 15G).
- Conservation of points is ensured over a long period of time.

The materialization of the points of the geodetic mesh grid. The material of the new points determined by the GNSS procedure, for the support and lifting network shall be made with FENO type terminals according to the norms in force, accepted also by the beneficiary.

Apparatus used for measurements. Measurements can be made with 3 receivers on two wavelengths (L1, L2), the measurement methods being static, for the points that determine the polygon (the points in the national geodetic network - at least 4 points) and the fast static, for the new points determined from the support and lifting network of that lens, or using TransDat to stop using the coordinate transformer polygon.

Performing GNSS measurements according to the technical regulations in force approved by A.N.C.P.I. GNSS measurements by the static method with selected intervals of processing of selected five-second GNSS signals or fast static for new points in the lifting network. The bases determined by the points where it was stationed with the GNSS receivers have lengths between ~ 20m and 10-15km for L1 and L1, L2 unlimited.

PDOP values fall within the optimal range between 1.5-4. During the measurements some PDOP bases may have high values due to intersection with the measurement period of other receptors but for short periods (<5 min) or because of the "poor" configuration of satellites, these bases being removed from processing. The number of observed satellites should be between 5 and 15-20 satellites.

RESULTS AND DISCUSSIONS

Calculation and compensation of GNSS measurements. Processing of G.P.S measurement data, calculation and compensation of the geodetic weaving network, the precision required for the processing of this data is in accordance with the norms. The points in the support and lifting net are generally accurate to the precision required by the norms which in the zone must be within ± 20 cm and must be determined from at least three vectors.

The WGS '84 reference coordinate transcalculation in the Stereogram'70 system can be done with the Toposys program for static and fast static points or with TransDat.

Calculation of transformation coefficients can be done based on common points chosen from the state geodetic network. This choice was made because at the end of the transcalculation an overall accuracy of the good coordinates is obtained. This transformation results in a file with stereographic coordinates x, y, and H on the Krasovski ellipsoid.

You can make a spatial transformation with 7 parameters (3 rotations, 3 translations and the scale factor). The transform coefficients are made on the basis of the common points chosen from the state geodetic network.

After the spatial transformation begins the process of inverse transcalculation. So from geocentric coordinates ==> geographic coordinates => stereographic coordinates'70, both for the points in the geodetic network and for the points in the grid.

The points in the support and lifting network determined by satellite methods can be determined with an accuracy of 2-3 mm, the compensation being done as a free network, and after the three-dimensional transformation results the transformation preferences, in

fact the differences between the coordinates of the old points of the National Geodesy Network and the coordinates of the same points determined by GNSS technology.

Accuracy of measurements after calculation and measurement compensation. Based on the comparison of the 1970 stereographic coordinates of the triangulation points with the coordinates resulting from the GNSS determinations of the same points, it results that the differences between the coordinates of the points determined by the triangulation method and those determined by the GNSS method and they must be within tolerances.

The differences obtained between the coordinates of the points in the state geodetic network and the coordinates determined by GNSS measurements in the case of spatial transformation were calculated before ROMPOS was introduced and the permanent stations were at today's density.

From the technical point of view geodesic - topographic, the stipulations required by the beneficiary and the Technical Norms approved by ANCPI are ensured. The determined points for the lifting network can be used in the work as well as on other topographical measurements to be performed in the area .

CONCLUSIONS

In the use of GNSS measurements in the general (systematic) cadastral work, it is necessary to distinguish between the solutions obtained from postprocessing and real-time solutions, the post-processing being recommended and even mandatory, according to the norms, especially in determining the points in the support networks and lifting networks (of the track-laying stations used for total stations).

Real-time positioning is a matter of day-to-day application in the field of geodesic applications, as well as in the systematic cadastre, which are recommended in areas where the signal is stable and less in areas with houses and blocks or wooded areas.

Real-time positions can be made using the solutions offered by the construction companies or the correction data provided by certain permanent station services in ROMPOS Romania.

With a rover, it is possible to position in real time using the signals transmitted to the reference stations, if a receiver and a data transmission system are available, and in the general cadastre it is recommended that the limit points be doubled or receive fixes from two distinct permanent stations (initialization must be done for at least two permanent ROMPOS networks).

These data are made available in real time, so that a substantial amount of time can be saved in data processing. Costs are small, as only one receiver is used, but at least two routers are recommended to increase efficiency.

The differences that can occur when comparing the results of the classical measurements with the RTK measurements are in the range of ± 2 cm to ± 4 cm.

These differences are due both to measurement errors and to the use of different antenna or function types and the reception of satellite signals.

The precise determination of the antenna phase center error is currently a very important factor in achieving the expected specifications and this is also taken into account in the general cadastre works.

We can see the dependence of initialization time on the number of satellites and their configuration. High initialization times are an indication of inaccurate measurements and erroneous resolution, ambiguities, and this aspect is intolerable in general cadastre work.

As a disadvantage of the system it is necessary to emphasize the dependence on the relief of the measurements, but also the dependence on the reception of the satellite signal, but also on the reception of the mobile telephony signal in the area where the measurements of the details of the general cadastre are carried out.

The main problem of real-time measurements remains wave propagation. It is considered that an exit from this deadlock can only be achieved through GSM, but it is also limited in certain areas.

Another problem is the obstruction points influenced by the multipath effect. They can cause a reduction in safety and precision, and now, even if two Global Positioning Systems (GPS + GLONASS) are used, GNSS, the multipath effect is the most common cause of signal failure especially in construction areas.

It is recommended that RTK measurements be used only when a second independent set of measurements is available and in an open field without too much obstruction around the measuring point.

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