SOME ASPECTS ON INTENSIFYING THE GEODESIC NETWORK BY MEANS OF G.P.S. MEASUREMENTS FOR THE PURPOSE OF CADASTRAL SERVICES IN WESTERN ROMANIA

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Abstract: *The paper is aimed at network sampling by intensifying the geodetic network to achieve cadastral works outside the city limits of Lăţunaş, Timis county. Given the scope of the project, the location as compared to the national geodetic network, and the kind of relief in the given area, we opted for sample networking by means of GPS measurements. We chose to conduct the measurements by employing the static method, which provides the highest precision. The sampling network, hereafter denominated secondary network, was placed approximately at the centre of the measurement area. In order to achieve a high level of accuracy, we opted for using higher order geodetic signals (order I and II). The signals employed as a base were chosen so as to form a triangle. However, the vicinity of the focus area to the Serbian border imposed that the two newly determined points remain outside the southern base of the main network Nonetheless, given that the distances were well under the maximum accepted value, 10% of the base lengths, errors are virtually negligible. The working equipment consisted of 4 GPS dual frequency receivers, namely: two receivers from the HIPER Plus series and two from the HIPER Pro series of the Japanese manufacturer TOPCON. The latter have a built-in radio mode, thus allowing configuration in the RTK system. Being of dual frequency, the receivers were able to record P code signals. Given the possibility to use up to 20 channels on the receivers, it was also possible to make simultaneous use of both satellite systems. It was established that three signals from the national geodetic network be stationed on the sample area with fix receivers: Sumiga (order I), Dealul Corcanu (order II) and S-E Moraviţa (order I). The second phase on the land plot includes the execution of the cadastral surveys, with the four teams perambulating according to the planned works. The first three teams covered the signals from the national geodetic network, while the fourth team perambulated the area where the three new points had been positioned. A surveying session was completed for each of the new points with three fix references on old points and a reference point on the new points: S100, S200, and S300. The next step was to download and process the field data by using the Leica Geo Office Combined software. The drafting of the plans for primary and secondary networks was performed by using the AutoCAD program. The new reference points outside the city limits of Lăţunaş will be used in the cadastral surveying to be performed.*

Keywords: *GPS sampling, the static method; GDOP value (Geometric Dilution of Precision; primary network.*

INTRODUCTION

In the current context and in perspective, the functioning of market economy based on coexistence and complementarity of the two forms of property - public and private - require the establishment of distinct land records, delineating each plot, with or without buildings, in the absence of which free movement of land and property security are inconceivable (1).

MATERIAL AND METHOD

The static method was used in the Lăţunaş project (2). The equipment employed consisted of four dual frequency GPS receivers, namely: two receivers from the HIPER Plus

series and two from the HIPER Pro series of the Japanese producer TOPCON. Having an in-built radio mode, the latter two permit their configuration in the RTK system. As the receivers display cutting-edge technology and dual frequency, these were able to record P code signals. Given the possibility of the receivers to use up to 20 channels, it was possible to use both GPS satellite systems simultaneously.

RESULTS AND DISCUSSIONS

The surveying evolved in several stages:

- planning GPS measurements
- the field stage and the office stage, i.e. downloading and data processing

During the planning sessions it is recommended to allocate time intervals in which the GDOP value is low. This enables us to analyze the influence of the available satellites geometry upon the working area. Figure 1.1 represents a graph with the DOP values for the place, date and time of the measurements and Figure. 1.2 presents the satellite constellation above the locality Lăţunaş.

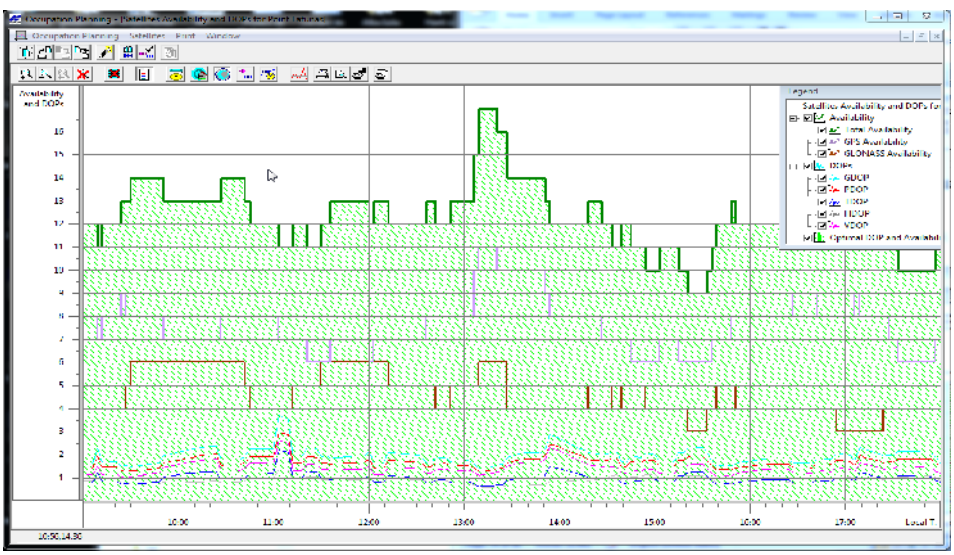

Figure. 1.1. The DOP values graph for Lăţunaş

The maps used in the project had a 1:100.000 scale with the following nomenclature: L-34-91; L-34-103; L-34-104. Projected upon these was the primary network consisting of geodetic signals (see Table 1.1), which was stationed with fix receivers.

Orthophotomaps were used to identify access roads, potential obstacles, and the actual configuration of the land outside the city limits of Lăţunaş.

In the field phase, after the identification of the plot had been performed, the next step included the measurements. A session of measurements was completed for all new points with three fix references on old points (Sumiga, SE Moravița, and Dealu Corcanu) and a landmark reference on the new points in the following order: S100, S200 and S300 Figure. 1.3.

While moving from one point to another, holding the receiver as a reference point, all the other receivers stopped. Subsequent to the new point positioning in the station, a new

measurement session was resumed. Coordination and synchronization have been carried out in good conditions thanks to GSM technology.

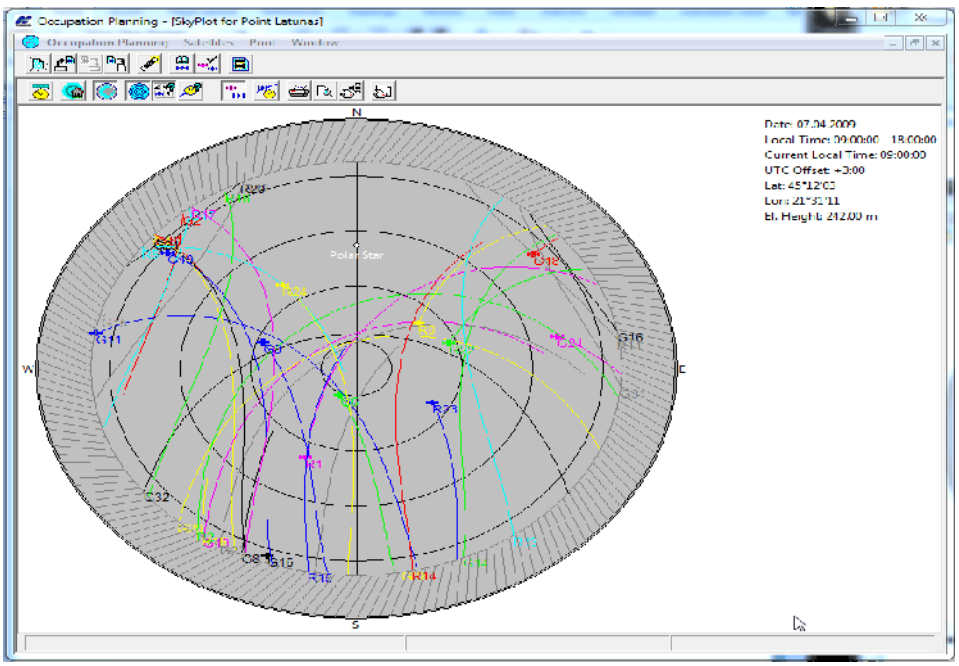

Figure. 1.2. The constellation and satellite trajectory for Lăţunaş

Table 1.1

Coordinates Table - old points

Nr. Crt.	Signal denomination	Order	Coordinates (Stereographic Projection system 1970, Altitudes System Marea Neagră 1975)		
			X	Y	H
1	Signal Sumiga	I	437949.094	219306.410	197.634
2	Signal Dealu Corcanu	II	417168.408	226789.623	198.054
3	Signal Moravița S-E	I	423909.538	205046.985	91.514

The office stage included the downloading, storing, and processing of data. The TopCON-PCCDU software was employed for data downloading. The software Leica Geo Office Combined was used for data processing with the ADJUSTMENT option.

The absolute rectangular coordinates of the new points (S100, S200, S300) are shown in Table 1.2, allowing the elaboration of the intensifying network (Figure. 1.4).

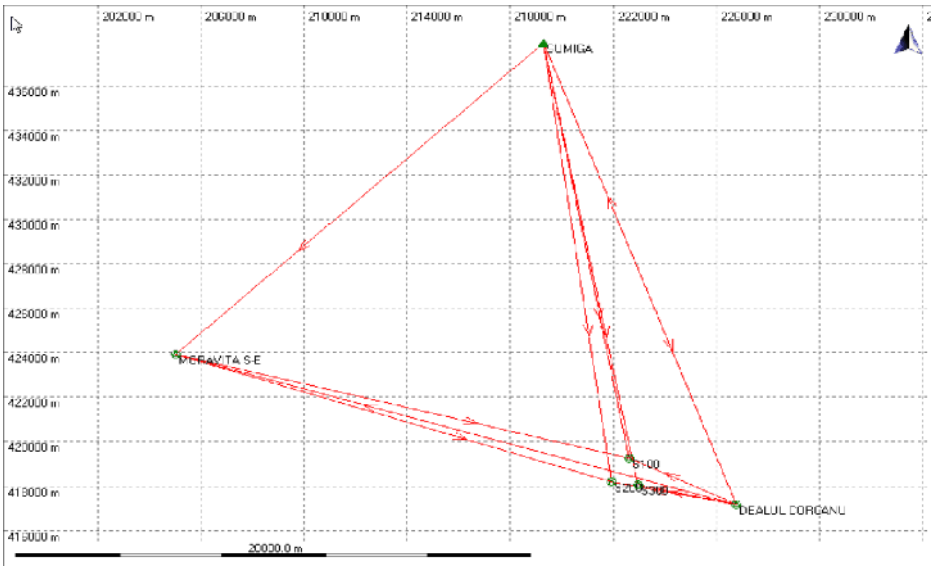

Figure 1.3. Sketch of the network

Table 1.2

Coordinates Table - new points

Nr. Crt.	New point denomination	Coordinates (Stereographic Projection system 1970, Altitudes System Marea Neagră 1975)		
		X	Y	H
1	S100	419270.8698	222619.2231	171.5452
2	S200	418194.0384	221949.8663	182.6089
3	S300	418051.4199	222973.9496	167.1591

CONCLUSIONS

Given the measurements precision obtained for each point following the enhancement of the network, we consider that the static method provides the highest accuracy in determining rectangular coordinates.

The support points determined by GPS will be used in cadastral surveying in the locality Lăţunaş FromTimis County.

Using the static method in the project from Lăţunaş has also prompted another advantage in obtaining a set of seven transformation parameters (HELMERT) which are valid over an area of approximately 20 km2 within the primary network.

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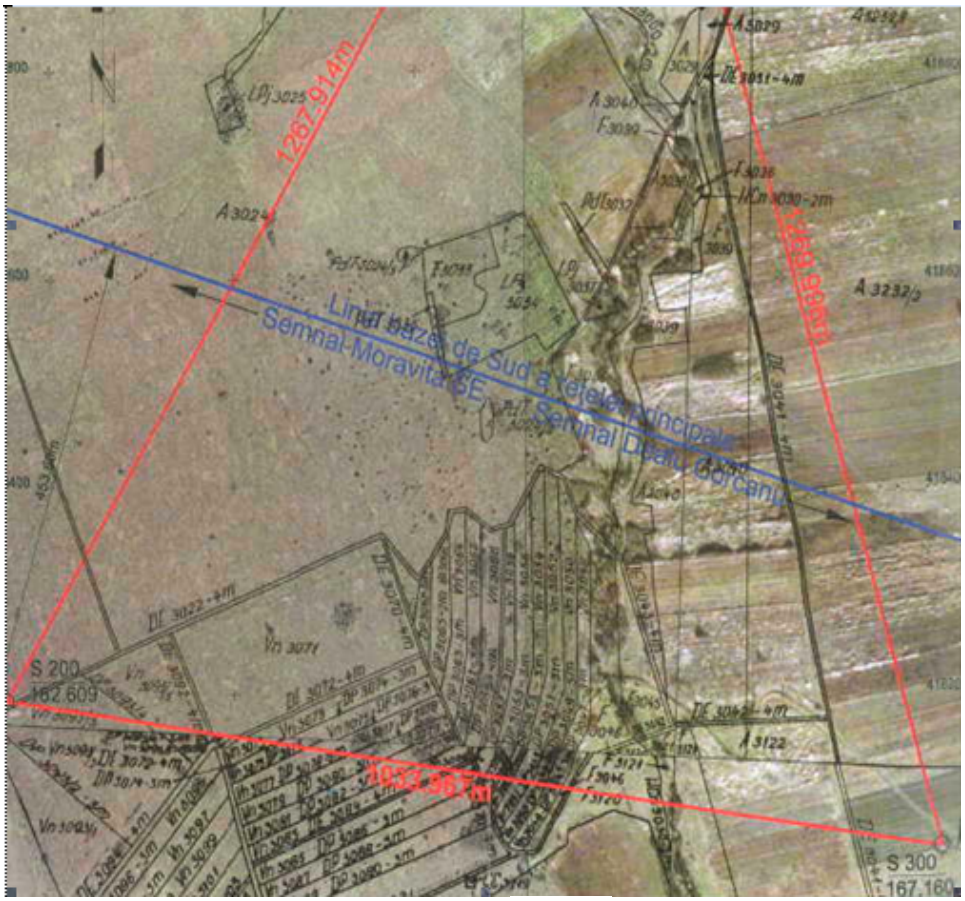

Figure 1.4. Sketch of the intensifying network