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USING GNSS TECHNOLOGY IN CADASTRAL DELIMITATION ACTIVITY AND MAKING THE TOPOGRAPHIC SUPPORT NECESSARY FOR THE ELABORATION P.U.Z.

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Abstract

The paper aimed to present the realization of an urbanistic plane in area Rădoaiei rivulet from Şinca Nouă and a cadastral delimitation between the Territorial-Administrative Units of Şinca Nouă and Codlea from Braşov county using GNSS technology. The data processing has been achieved with specific methods thus resulting the topographical plan on the area discussed above. Using the measurements a comparative study of the boundary's coordinates has been achieved , utilizing specific softs. Thus, a differences between using satellite registrations in simple frequency (carrier wave L1), and in double frequency (combination of carried waves L1 and L2) resulted.

Keywords*: cadastral delimitation, GNSS technology, satellite, topographical plan.*

INTRODUCTION

The present paper aims to provide topo-geodesic measurements and drafting the topographic support in order to make the Regional Urban Planning (P.U.Z.) for the area near the Rădoaei rivulet from Şinca Nouă Place, Braşov County. Also, in this project are presented aspects related to the use of GNSS technology for the determination of border points coordinates and those at the limit within the build-up area belonging to Territorial-Administrative Unit of Codlea, from Braşov County. This activity took place within the operation of cadastral delimitation in the County mentioned above, which is neighbored in the west side with the Territorial-Administrative Unit of Şinca Nouă, where is located the land object to topographic measurements for this project. Based on the data gathered for this operation, a comparative study was made for the coordinates of border points determined using satellite registrations in simple frequency (carrier wave L1), and in double frequency (combination of carried waves L1 and L2).

The study area covers Codlea Municipality, located in the North-West of Ţării Bârsei, at the foot of Măgura Codlea (1291,5 m), at 15 km from Braşov Municipality and neighbored with the following Territorial-Administrative Units: to the East with Hălchiu and Ghimbav, to the South with Râşnov and Vulcan, to the West with Holbav and with Şinca Nouă, and to the North with Dumbrăviţa, and with Şinca Nouă Place which is located at the foot of Făgăraş Mountains, on Şinca valley, at the altitude of 537m, at a distance of 50 de km from Braşov Municipality.

Figure 1. Territorial administrative units: Şinca Nouă, Codlea

METHODS AND EQUIPMENT

For the elaboration of direct measurements it was used a high-tech device manufactured by Leica Geosystems such as: the total station Leica TC405 and GNSS equipment Leica GPS12 model.The measurement method using the total station was the traversing method combined with the cancellation method (polar coordinates) and with GNSS technology, static measurement method.

The applications of modern GNSS technology in this project were the following:

- the positioning of thickening network, which contributed to the land survey, in order to obtain the topographic support for the elaboration of Regional Urban Planning for the area near the Rădoaei rivulet from Şinca Nouă Place;
- the determination of coordinates of border points and those on the limit within the build-up area of Codlea Municipality.

The data processing was made by compensating the measurements covering the following methods:

- classical method,
- rotation method and scale application,
- using TopoSys program.

Also, it was used the Mathematical Statically Method for the comparative study of coordinates of border points by using satellite registrations in simple and double frequency.

RESULTS AND DISCUSSIONS

In order to achieve the final objective, there were followed the stages specific to topography, making specific measurements and using complex methods which allow us to obtain complete and accurate results. Firstly the cartographic base was identified starting from cadastral map nomenclature at 1:50.000 scale for Şinca Nouă Place, the orthophotos 517-467 and 517-469 which are overlapping to the land in subject and the nomenclatures of topographic plans for the interest area, namely L-35-75-C-d-2-II and L-35-75-C-d-2-IV,all of them at 1:5000 scale .

The measurements provided on field contributed to the elaboration of topographic plan, more precisely, the execution of an upward network made of 3 combined traverses, including 11 new station points. In order to determine the planimetric coordinates of station points, it was used the planimetric traversing method supported at edges by known coordinate points and sides with known orientations, and for the determination of quotas of these points, it was used the traversing method of trigonometric leveling at edges on points with known quotas, provided simultaneously with the planimetric traversing.

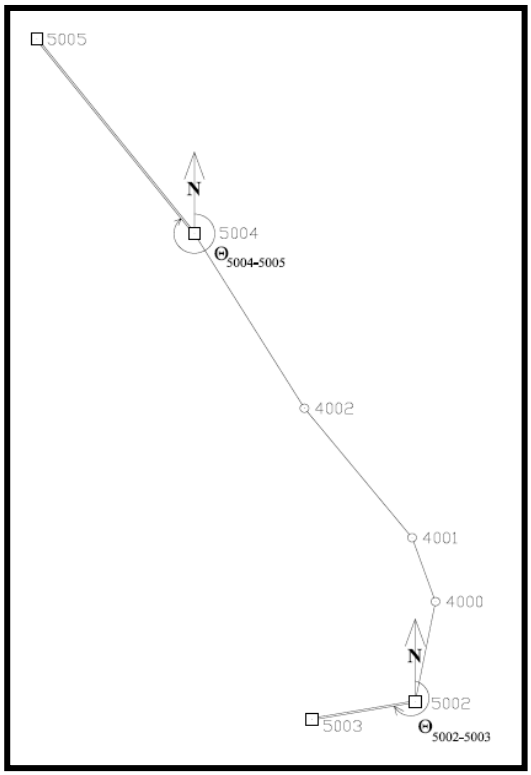

Figure 2. The roadblock I

The operation was made with the local station Leica TC405, whereby it was provided the land survey of details using the method of polar coordinates. The purpose was to cancel as much as possible the details for the elaboration of a topo plan, able to display as much as accurate as the situation in field.

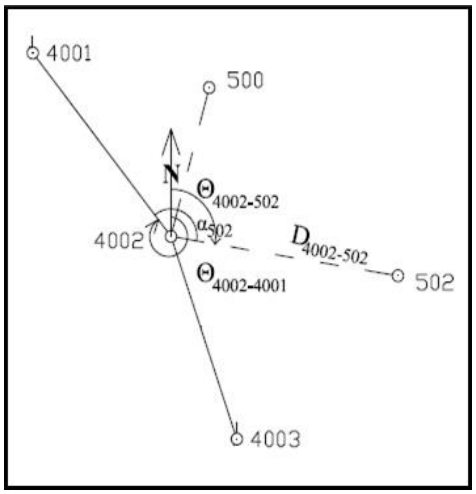

Figure 3. The land survey of details

Data processing and the calculation of coordinates of new traversing points weres made using three methods: classical method, rotation method and scale application method, and by using TopoSys program (related to accuracy).

The points which contributed to the enclosure into the geodesic thickening network have been determined with GNSS technology, using the static measurement method. The operation is based on GNSS stations from the national geodesic network located in Sfântu Gheorghe and in Făgăraş.

The operation for cadastral delimitation of the Territorial-Administrative Unit of Codlea from the Territorial-Administrative Unit of Şinca Nouă was provided by using GNSS technology which insured a high accuracy and an increased efficiency of determinations, and they implied the cover of land in October – November, establishing the border points and the points on the limit within the build-up area, their marking with bollards and the determination of coordinates. So, 82 bollards have been placed on the limit within the build-up area and 102 bollards on the border of the Territorial-Administrative Unit of Codlea.

Figure 4. Bollards located on the ground

As we can notice from the previous chart, the differences between the coordinates of border points determined with the processing of satellite registrations in the two variants (setting LEICA Geo Office software for Frequency parameter value L1, and L1+L2) are very small.

The final objective of these works is the elaboration of a topographic plan. This piece was made with AutoCAD – Autodesk Land Desktop 2005 program, being present in both digital and analogical format at 1:1000 scale.

The comparative study of the coordinates of determined border points have been obtained using satellite registrations in simple frequency (carrier wave L1), and in double frequency (the combination of carrier waves L1 and L2). The post-processing of data gathered with GNSS sensors in the two variants was made with LEICA Geo Office program. For the first processing variant was chosen the frequency L1, and for the second variant was chosen the combination of frequencies L1+L2. It is important to mention that the rest of parameters have been set identically for both variants of processing. Following this action two sets of coordinates have been obtained for each border point, whereby were distinguished the differences between the two satellite registrations.

In the following table is presented an excerpt of the coordinates obtained by using satellite registrations in simple and double frequency, but also the differences between them, for a number of 20 border points.

Table 1. Extract coordinates obtained using single and double frequency satellite recordings

Point Nr.	L1			L1+L2			Differences		
	X [m]	Y [m]	H [m]	X [m]	Y [m]	H [m]	ΔX [m]	ΔY [m]	ΔH [m]
B1	464949.608	536445.641	555.836	464949.609	536445.639	555.834	-0.001	0.002	0.002
B2	465312.762	536649.946	551.889	465312.761	536649.947	551.899	0.001	-0.001	-0.010
B3	465819.784	536636.683	548.931	465819.782	536636.682	548.915	0.002	0.001	0.016
B4	466069.684	536199.734	549.331	466069.683	536199.732	549.305	0.001	0.002	0.026
B5	466219.717	536140.378	548.183	466219.718	536140.378	548.214	-0.001	0.000	-0.031
B6	466374.508	535963.232	547.203	466374.507	535963.232	547.206	0.001	0.000	-0.003
B7	466560.594	536182.444	546.278	466560.592	536182.442	546.275	0.002	0.002	0.003
B8	467111.316	536455.741	542.946	467111.318	536455.740	542.961	-0.002	0.001	-0.015
B9	464409.600	535384.237	560.401	464409.601	535384.237	560.409	-0.001	0.000	-0.008
B10	464077.158	535984.329	560.952	464077.159	535984.330	560.974	-0.001	-0.001	-0.022
B11	464907.741	536437.055	555.584	464907.744	536437.055	555.600	-0.003	0.000	-0.016
B12	467243.100	536243.347	542.538	467243.102	536243.347	542.547	-0.002	0.000	-0.009
B13	465648.584	533959.690	574.423	465648.585	533959.691	574.425	-0.001	-0.001	-0.002
B14	465368.357	533794.172	571.431	465368.356	533794.173	571.431	0.001	-0.001	0.000
B15	465125.607	534284.728	558.238	465125.607	534284.728	558.244	0.000	0.000	-0.006
B16	464581.542	534083.077	562.896	464581.543	534083.077	562.897	-0.001	0.000	-0.001
B17	464426.818	534459.430	562.151	464426.817	534459.433	562.152	0.001	-0.003	-0.001
B18	463655.500	534376.392	565.894	463655.504	534376.385	565.910	-0.004	0.007	-0.016
B19	462974.824	534204.285	570.318	462974.824	534204.285	570.320	0.000	0.000	-0.002
B20	462919.372	534572.331	571.124	462919.373	534572.332	571.123	-0.001	-0.001	0.001

The graph below shows the distribution of the differences obtained on the X, Y and H coordinates on the size classes.

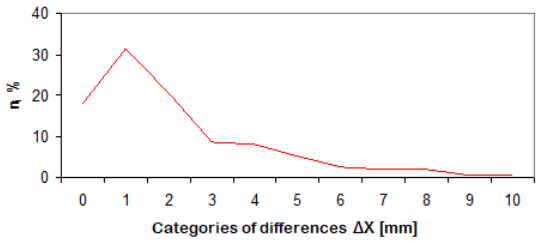

Figure 5. Percentage distribution of differences ΔX

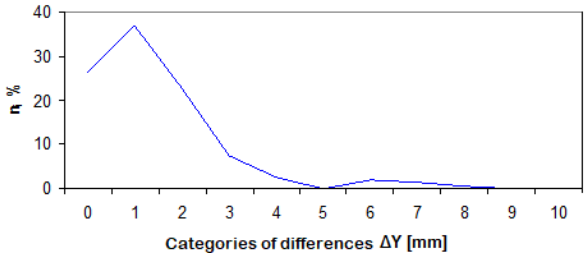

Figure 6. Percentage distribution of differences ΔY

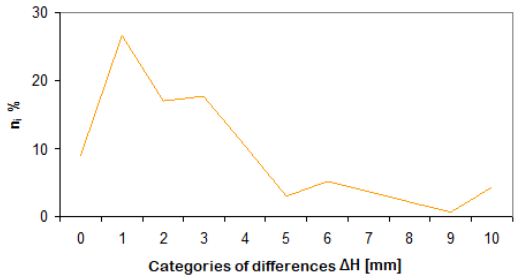

Figure 7. Percentage distribution of differences ΔH

As can be seen from the previous graphs, the differences between the coordinates of the boundary points determined by the processing of the satellite recordings in the two variants (by setting the L1 and L1 + L2 values in the LEICA Geo Office software for the Frequency parameter) are very small.

The works have as final objective the drafting of the topographic plan. This piece was created with the help of AutoCAD - Autodesk Land Desktop 2005, both in digital and analogue format at 1: 1000 scale.

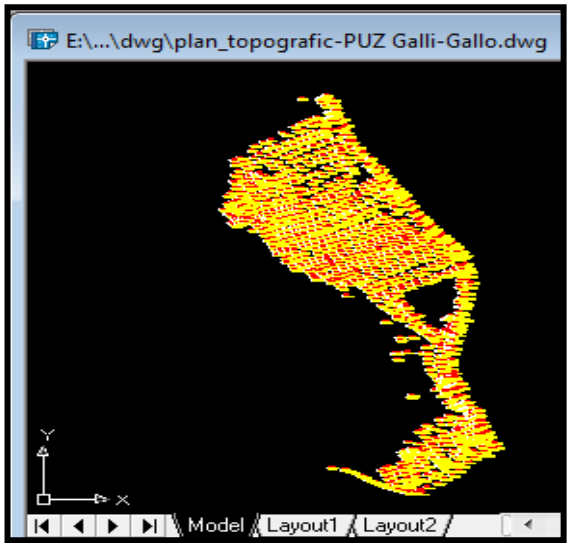

Figure 8. The imported points window

CONCLUSIONS

In conclusion, all the stages covered, both on field and in office, have led to a full achievement of the papers' purpose. On the one side, choosing the appropriate topographic

devices and methods, was made the topographic plan which satisfies the project's requests for the elaboration of Regional Urban Planning of Codlea Municipality. On the other side, the comparative study of the two variants for determining the points coordinates with GNSS technology emphasized the differences of the two types of registration, being recommended the use of sensors in double frequency.

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