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Topographic Survey for Update Cadastral Data of an Imobile from Giarmata Timiş Country

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Abstract The purpose of the paper was to present a model for drawing up and carrying out a topographic survey of a plot and of the constructions related to the surface, in order to update the data of a building with the verification of the surface existing in the land book.
Due to the small tolerances allowed, it was absolutely necessary to hire a topography company to execute the identification of the land and the constructions.
This type of work requires a large volume of work both in the preliminary phase (where information on the former properties are studied and sought) and in the execution phase, which requires the measurement of areas of land without visibility between points.
In order to identify and delimit the properties or to identify the constructions, it is imperative that the specialist surveyor be well informed about the data and plans already existing in the OCPI archives, data that must coincide with the topogeodetic surveys resulting from the field measurements.

Keywords: GPS, real estate data update

1. INTRODUCTION

Concerns in the field of urban space configuration have crystallized into a new, complex activity, which is in the direction of studies and theoretical and practical approaches of great importance, topicality and scope, all over the world. The origins of urban planning - legitimized around 1955 - are highly branched. On a "level", modern urban planning is an extension of the old studies and practices related to pre-modern models (by imposing rules that aim to ensure a healthy environment, safe and last but not least, pleasant for the inhabitants, bringing political benefits to the urban elites and to reach high levels of cultural spirituality). On another "level", the modern planning is constituted in an approach with special valences, based on an inexperienced way of working so far: it is operated with and in a broad socio-economic-political framework, in which any modification physical or functional terrain is negotiated between competitive interests. The activity related to the modern urban planning is carried out in a stage of development of the humanity in which the purpose of the planning is no longer to impose the human order of nature, but to impose - in a continuous and coherent way - order on the city itself. (Hall apud LeGates and Stout, 2003, pp. 339-343).

Under the accentuated urbanization, constructions of all types are the largest consumers of land. The efficient and correct management of all the problems related to the cities is conditioned by ensuring, first of all, the balance of the existing balance of interests in the society, which can only be achieved by highlighting the functioning of the complex individuality of the respective territory. The lands and constructions, of all categories and sizes, have become - during the evolution of the society - immovable property object of public and private property, benchmarks both for determining the degree of economic development and for the social, cultural, educational hierarchy of the states of the world. In this context, the need to inventory these goods for the purpose of quantifying their value (especially for taxation) was felt and imposed, in order to obtain an accurate record of the settlement, extent and holders, from technical, legal, social, and environment protection. This approach has now materialized in the system of registration of the cadastre and real estate advertising, after, of course, a series of steps have been followed, which mainly followed two aspects related to the immovable property: the extent and the quality of land and buildings and the establishment of the owners with any title of these goods. These aspects interested both the state in order to establish the taxes, and to ensure an adequate social tranquility, as well as to the legal holders, in order to prove and guarantee the right of property and some dismantling of the right of property. It is remarkable that, at first, the fiscal character of the records predominated, but - over time - their legal character became predominant.

The use of total stations over the last 10 years has allowed the rapid and accurate data collection, directly, in the form of coordinates. However, in many applications the use of total stations is made difficult by providing the sighting line as well as the maximum distance that can be measured. Another problem in the

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conditions of our country is the one related to the expenses needed to signal the geodesic points, an action which - in about 60% of the cases - needs to be redone, which leads to very high material and labor costs.

The use of GPS equipment has the advantage that it does not require angular and distance measurements, eliminating the disadvantages of using the total stations, while it is worth mentioning that by developing the kinematic stop / go method it is possible to determine coordinates with an accuracy compared to that provided by the total stations and within a convenient time frame. In parallel with these advantages, the need was also considered for Romania to be able to align itself with European and international standards by developing a high precision GPS reference geodetic network, the points of which will be determined and included in the European GPS geodetic network.

In view of the above, as well as the fact that the use of GPS equipment together with the total stations, does not constitute an overlap and that - through separate or joint use, depending on the specificities of the work areas - the disadvantages of each system can be eliminated, the solution was to introduce the GPS technology in the process of measuring and re-measuring support networks in our country.

2. MATERIAL AND METHOD

Depending on the number of receivers used, in the GPS system, two basic concepts are distinguished:
- absolute positioning of a single receiver, based on the measurement of the phase of codes and pseudo-distances, which ensures order accuracy of the meters, of moving vehicles, also called the navigation solution.
- relative or differentiated positioning, using at least two receivers, one installed at a known point and the other at new points to be determined, based on the measurements of the code and the carrier wave phase.

Real-Time Differential GPS (RTDGPS), also known as Real Time Kinematic (RTK), eliminates the main drawback of static and kinematic methods and processes. RTK allows the immediate determination and knowledge of the coordinates of the mobile receiver, including checking the quality of the measurements and fixing them as needed.

The differential GPS technique allows the observation of the errors of measurement of the pseudo-distances, towards the four satellites, in a reference point known precisely in the WGS 84 System. On a permanent GPS station with a receiver module with 12-16 parallel channels, it determines for each mobile station the difference between the measured and theoretical distance obtained from ephemerides and the known position of the reference station. The corrections are transmitted through UHF waves permanently to all mobile receivers located at least 40 km away.

For the application of this modern technique, it is taken into account the condition that the receivers see at the same time at least four satellites and have the corresponding equipments: a radio equipment for transmission and receivers and a software of differential processing.

RTK technology has an advantage, namely: the correlation and correction of distance errors with the transmission of radio waves data and the real-time, on-the-ground provision of the coordinates of the new points, including information about their quality.

After the measurements, the radio links and the corrections are applied, the GPS coordinates in the international System WGS 84 are displayed in real time, directly on the field.

The modern receivers have adequate programs that include the calculation of the seven Helmet transformation parameters, obtained previously based on the common points of both systems, thus ensuring, directly on the ground, the passage of the coordinates in the national datum.

The processing of GPS data involves a set of works aimed at their processing until the spatial coordinates of the points of the thickening network in the national geodetic data are obtained. The operations are carried out automatically with the help of software only that the operator is the one who decides from choosing the working method, selecting the input elements until establishing the necessary constraints.

There are two options for choosing the working mode: by post-processing, in the case of using classical GPS technology, or in real time.

The real-time process consists of transmitting the data via UHF radio when the field coordinates are obtained directly in stereographic 70 using a complex program based on 7 Helmet transformation parameters for the region in the case deduced on the basis of common points in both, the international and national datum.

Real-time processing is based on the calculation of the fixed receiver coordinates installed at a known point and the new points, starting from the signals received from at least four common satellites. By comparing the values with the known old ones of the reference station, a position correction is calculated which the fixed receiver transmits by radio to the mobile receivers. They must be equipped with radio links and a program to recalculate the provisional coordinates in order to transform them into definitive values.

Surveying the details is the operation that occupies the highest volume of work within the survey in the plan. As an estimate of this statement, if in a topographic survey the position of 10,000 points was determined by measurements, of which a number of the units order (for example about 5) can be thickened, the traverse points can be of the tens (of 40-50), and the rest are detail points. These figures are meant to show the importance of topographic survey and why we need to pay attention to this topic.

The topographic survey is the operation by which the position of the characteristic points of the details related to the points of the topographic network, the relative position of the details, their shape and dimensions is determined. By detail is understood everything that exists on the land surface, either of natural origin (valleys, rivers, peaks, vegetation, etc.) or artificial: (roads, constructions, property boundaries, etc.). Altogether, the details make up the content of a plan.

The details can be planimetric or altimetric and they make up the content of a plan as a whole. The details can be broken down into characteristic points, chosen when changing the direction of the contour (for rendering

the planimetry) or for changing the slope of the terrain (for rendering the relief).

The topographic survey of the details involves the following steps in the field:
- the decomposition of details into characteristic points;
- determining the position of the characteristic points with respect to those of the lifting network. At the office, a series of calculations are made, specific to each lifting method in the plan, followed by the report in the plan.

Depending on the elements to be determined, the topographic survey in the plane can be combined (when the position of the characteristic points in the plane and on the points height is determined), planimetric (determining the position in the horizontal plane only) and altimetric (when only the height is determined).

3. RESULTS AND DISCUSSION

The location of the immobile is located in the South-East part of the town of Giarmata, Timiș County. **Legal status of the building:** The immobile is listed in C.F. 405431, LOC. GIARMATA and is without any tasks.

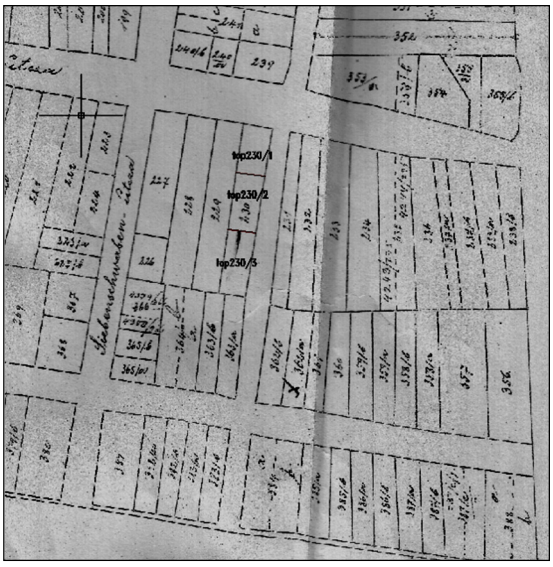

Figure 1. Placement in the area of the plot

Plot with cadastral number 405431 is located in the urban area of GIARMATA, no. 854, Timis County and neighboring as follows:
- at NORTH: top 230/1
- at WEST: top 229
- at EAST: DS21 Tineretului street
- at SOUTH: top 230/1

The terrain that is the subject of these topographic works is delimited by the fence, which in principle required a verification, by a topogeodetic survey

After identifying the land, the actual measurement was started. A GPS STONEX S9 III GNSS RTK L1 L2 GPS system was used to determine the point coordinates with GPS technology.

The measurements were performed using the RTK (Real Time Kinematic) method.

RTK technology thus provides a basic advantage over those mentioned: the correlation and correction of distance errors with the transmission of data by radio waves and the real-time, on-field provision of the coordinates of the new points, including information on their quality.

This opens up new opportunities for the GPS system, with high efficiency and a good accuracy of ± (10mm + 3ppm), equivalent to the kinematic method, fully satisfactory for the thickening networks.

Setting up the router for GPS / GNSS working mode in ROMPOS

Figure 2. Rover setting

- GPS setting for working mode in ROMPOS:

Figure 3. GPS setting for working mode

As a point of reference in the GPS determinations, the Permanent Station of Timisoara (TIMIŞOARARef 0000) was used.

Permanent station coordinates Table1

COORDONATE ELIPSOIDALE - ETRS89				
Nume Stație Permanentă	Clasă	B[m]	L[m]	He[m]
Timişoara (Ref0000)	A	45° 46' 47.65271" N	21° 13' 51.46281" E	154.7278 m
COORDONATE STEREOGRAFICE 1970				
Nume Stație Permanentă	Clasă	X(m)	Y(m)	H(m)
Timişoara (Ref0000)	A	482495.124	207132.249	111.641

With the help of GPS, two points of station 125, respectively 119 were determined, which were materialized on the ground by wooden landmark.

Figure 4. The GPS points laying-out

Points were measured, in particular, along the linear details with permanent character of the terrain, such as canals, bridges, corners and edges of paved or paved roads, etc.

On the plots with abundant vegetation due to the lack of use of the neighboring lands, 5 m extensible stretches were used, thus obtaining detail points in the heavy areas. The detail points were survey from a single station, respectively S125, determined by GPS-Rompos by RTK method, the contour points of the plot with topographic number 230/2 and all other points, including landmarks, were surveyed.

In the work was used the total station LEICA TC 407, having an accuracy of measuring of 7^{cc} for the angles and of 2mm + 2ppm for the distances.

For the altimetric survey of the ground the height of the device was measured and thus it was possible to measure the H coordinate of each point on the ground, necessary to realize the plan of the area of construction site and of the land related to different destinations regarding the necessary utilities, respectively garage, kitchen summer, swimming pool and access roads, alleys, etc.

Thus, the topographic measurements for the detail plan were made in the field with the help of a total station from the contour points 1,2,5 and 6, where there was no direct visibility, respectively behind the property, which could not be determined directly from station point 125.

In order to carry out the situation plan as accurately as possible, 74 points were erased on the ground. The measurements were made in about 3 hours, by a team of three people. The situation plan was drawn up for the correct verification and location of the buildings in the property field.

At the same time, the land was searched for the two points determined using GPS in order to execute the topographic description of the geodesic points (Figures 5 and 6).

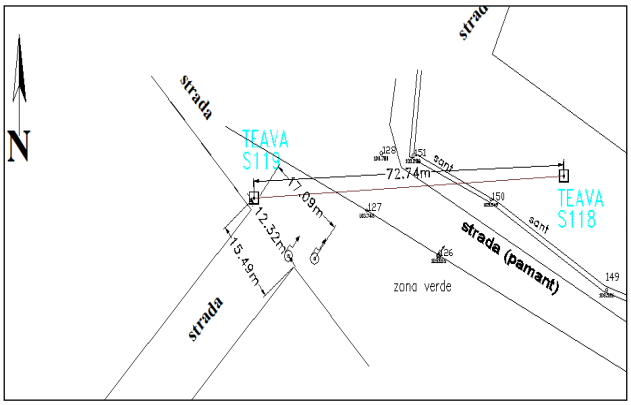

Figure 5. Topographic description of the geodesic point 119

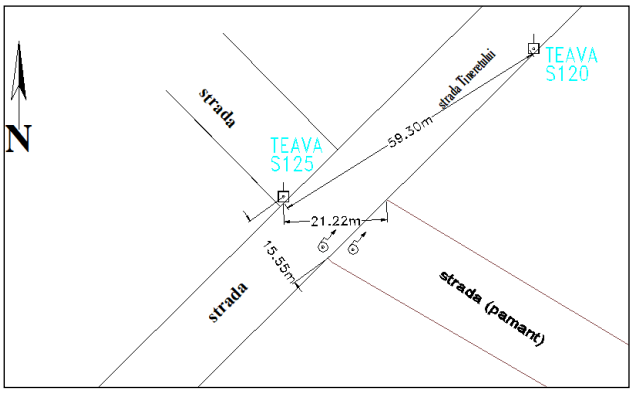

Figure 6. Topographic description of the geodesic point 125

Since the determination of the station points was done by GPS-RTK methods and the topographic lifting of the detail points was performed with the total station, directly in the Stereographic coordinate system 1970, Black Sea level 1975 system, it was no longer necessary to calculate the coordinates for the radiated points X, Y and H.

The download of the station was done with the Leica Geo Office Tools software, and the data processing was done with Autocad 2014.

The data transfer (electronic field book) from the instrument to the computer via the transfer cable was performed using the Leica Office Geo Tools program. The download resulted in a file with the extension *.gsi which was later converted to a *.dxf file using the generated DXF software.

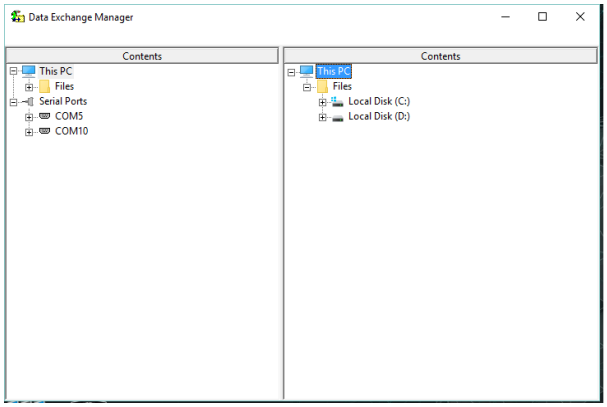

Figure 7. Leica Office Geo Tools – Data Exchange Manager

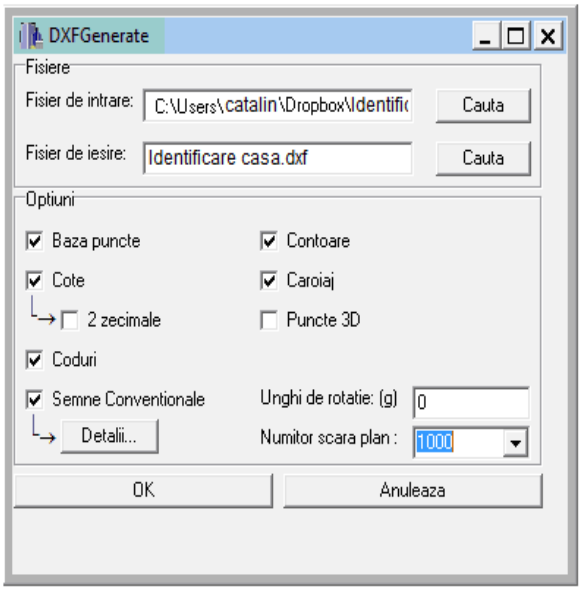

Figure 8 DXFGenerate

The electronic field book with the data from the Leica total station was prepared in electronic format.
The surface calculation was performed by analytical methods using the stereographic coordinates of the contour points of the building with cadastral no. 229, obtained from field measurements and after calculations.

$$2S = \Sigma X_i(Y_{i+1} - Y_{i-1})$$

S = 3206mp

T
hese coordinates and the calculated surface are presented in the table below:

Points coordinates Table 2

Nr. Pct.	X [m]	Y [m]
1	48832414	213981.830
6	488279.181	213967.018
7	488374.629	213975.115
8	488367.864	213996.115
9	488366.944	213995.848
10	488350.484	213991.076
11	488235.932	213952.534
12	488238.747	213944.506
13	488242.746	213930.014
67	488338.737	213962.838

Design verification was performed by measurements roulette for each building or annex. Through the AutoCAD program, all the diagonals for each building were checked by coordinates, from which they turned out to be rectangular shape. The differences found were of maximum 3 mm planimetric on the X, Y axes, the work falling within the tolerances allowed.

After the realization of the plan for the location and delimitation of the building, the cadastral documentation was drawn up, which reflects the reality of the data measured in the field and contains the following written and drawn pieces:

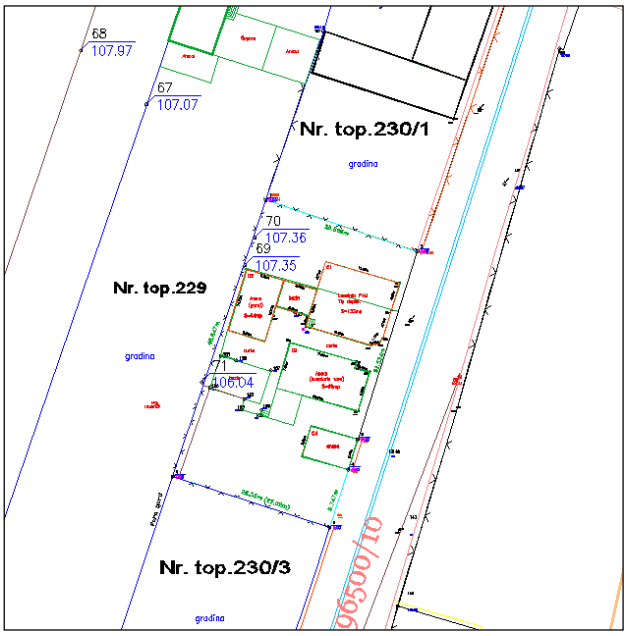

Figure 9. Data processing with the elaboration of the situation plan

- Sheet, which contain the following data:
- property address;
- electronic identifier number;
- owner;
- authorized person;
- type of documentation Real estate data update.
- Request for receipt and registration plus the declaration according to order 700.
- Land Book Extract;
- Technical report showing:
- brief presentation of the situation on the ground and each electronic identifier for the building in question;
- topo-cadastral operations carried out mentioning each method used in data collection;
- the coordinates of the contour points of the building;
- the surface resulting from the calculation.
- Sheet resulting from measurements;
- Annex 1.36 Plans for location and delimitation of the building with the proposal to update the building data, scale 1: 250;
- Annex 1.35 Plan of location and delimitation of the building, scale 1: 500.

The documentation of the written pieces was realized with the Word software.

4. CONCLUSIONS

When executing on-site topographic works lifting the details, it is necessary to take into account the following aspects:

All topographic instruments must be checked and rectified.

The measuring tapes used in the tracing operation are checked for calibration purposes;

Before beginning the works of topographic survey of the details, the planimetric and height position of the points from the basic network use for stake-out will be checked out;

Measures will be taken to preserve and protect the points determined by GPS to which all the details have

been surveyed. The marking of the points must be made with increased precision by using metal sheets, nails, pegs, nails, pencil marks or other precision elements;

Any topographic survey must be followed by the verification operation, by more precise procedures or different procedures, in our case for each building their lengths and widths can be measured, and on the plane diagonals can be verified, so that their positioning is in geometric shapes to be rectangular.

Currently, topographic measuring instruments are new high precision instruments, thus reducing the execution time as well as the accuracy with which the coordinates of the contour points were determined.

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*[7]*** Ordinul 534/2001, modificat privind Normele tehnice de introducere a cadastrului general;*

*[8]*** Ordinul 700/2014 modificat, pentru aprobarea Regulamentului privind conţinutul şi modul de întocmire a documentaţiilor cadastrale în vederea înscrierii în cartea funciară;*

*[9]*** Ordinul 979/2016 privind aprobarea Specificaţiilor tehnice de realizare a lucrărilor sistematice de cadastru pe sectoare cadastrale în vederea înscrierii imobilelor în cartea funciară, finanţate de Agenţia Naţională de Cadastru si Publicitate Imobiliară;*

*[10]*** ORDIN nr. 700 din 9 iulie 2014 (*actualizat*) privind aprobarea Regulamentului de avizare, recepţie şi înscriere în evidenţele de cadastru şi carte funciară(actualizat până la data de 6 noiembrie 2014*);*

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