USE OF TOTAL STATIONS AND GNSS EQUIPMENT IN THE REALIZATION OF CADASTRE DOCUMENTATIONS FOR THE FIRST REGISTRATION IN THE LAND BOOK

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ABSTRACT

The paper presents an example of the use of total stations in combination with GNSS technology in order to obtain the topo-cadastral documentation of the first registration in the Land Book of a property. The elaboration of the documentation for a building located in Craiova, Brestei Street was studied. The building is composed of urban land with the category of use courtyards on which two constructions are built, one with the residential destination and the other with the annex destination. At the basis of the elaboration of the cadastral documentation were the measurements performed with the total station Trimble 3300 and the GNSS receiver Topcon GR3.

INTRODUCTION

The working procedures regarding the registration in the cadastral and land book records of the buildings, the approval and reception of the specialized works are provided in the Regulation for approval, reception and registration in the cadastral and land book records approved by Order 700 / 09.07.2014 of the General Director of ANCPI (amended and supplemented by ODG 3442/2019).

The realization of the cadastral documentation involved the following steps:

a) identification of the location of the building and technical documentation;

b) execution of field and office works;

c) preparation of documentation.

MATERIAL AND METHOD

The topo-cadastral surveying works were carried out using a Trimble 3300 total station and a Topcon GR3 GNSS receiver. The support network was made using the supported travel method at known coordinate points. Some of the support points were previously determined, for other works in the area, two other points were determined with GNSS technology and a well-known point from the national geodetic network was targeted. From the new station points, the detail points were raised using the polar coordinate method (radiation method).

The processing of the data obtained from the measurements was done with the TopoSys 4.4 program and AutoCad 12 was used to draw up the plans.

The identification of the site was made before the execution of the works and, being a building that was the subject of the first registration, consisted in identifying by the owner, together with the authorized person, the location of the building within conventional limits, in order to perform measurements.

The technical documentation consisted of:

a) analysis of the existing situation, according to the data and documents held by the owner, in relation to the existing elements in the field;

b) requesting updated information from the database of the territorial cadastre office. The request for data and

information in the database of the territorial office was made on the basis of a request.

RESULTS AND DISCUSSIONS

The execution of the works, of field and office, consisted in:

a) choosing the working method;

b) the execution of the measurements for the realization of the thickening and lifting networks, the lifting of the cadastral planimetric details located on the limit and inside the building, the collection of the attributes, verifications and validations of the existing data. The following documents were prepared to prove the measurements: by field book, network sketch, description of new thickening and lifting points, GPS reports, reports on the determined accuracies. All information and data resulting from the measurements have been archived by the authorized person;

c) the analysis by the authorized person of the boundaries of the buildings indicated by the owner, in accordance with the property deeds, the information taken from the territorial office and the measurements performed. The nature of the enclosures was mentioned in the site and demarcation plan in point "A. Land data" in the comments section;

d) the determination by the authorized person of the existing fixed elements on the land, inside and in the vicinity of the building and their representation on the location and delimitation plan in analog format.

e) data processing;

j) preparation of documentation in analog and digital format.

Figure 1. Framing in the area of the building

After studying the available documents, the terrain was recognized in order to verify the concordance of the data with reality and to identify the details necessary for the subsequent stages. The identification of the location was made in the presence of the owner. Based on the information gathered from the field, a sketch of the building was drawn up and used for the design of the support network, the establishment of methods for the construction of the network and the establishment of methods for raising the characteristic points on the property outline. Two points from the new city support network were identified on the ground (points 291 and 292) as well as a statically determined GPS point in a previous work (point 600). It was also found that there is visibility towards the Brestei Water Castle (point T109). All these old points were used to design the lifting network (Figure 2).

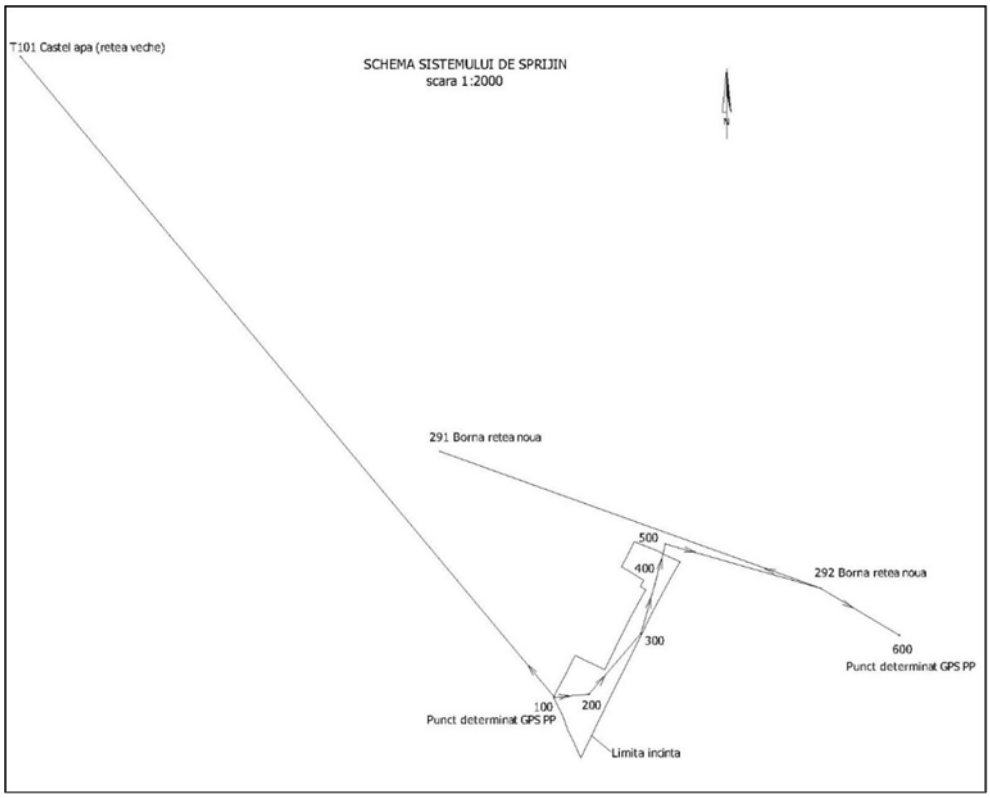

Figure 2 - Outline of the support network

The support network was made using the method of supported traverse on known coordinate points and known orientations as follows: it starts from point 100, determined static GPS using Craiova and Băilești GNSS stations, with orientation on the geodetic point T109; the points 200, 300, 400 and 500 shall be determined with the total station and the traverse shall be closed on the old point 292, with support on points 291 and 600.

To achieve the supported traverse it was necessary that the point 100 be determined GPS by post processing. In this case, the static method was used with three receivers, two permanent GNSS stations from the ROMPOS network (Craiova and Băilești) and the Topcon GR3 GPS receiver located on point 100.

The effective stationary time of the GPS session was 27 minutes and 10 seconds (minimum 3 minutes plus 3 min / 10 km distance from the fixed station) – Figure 3.

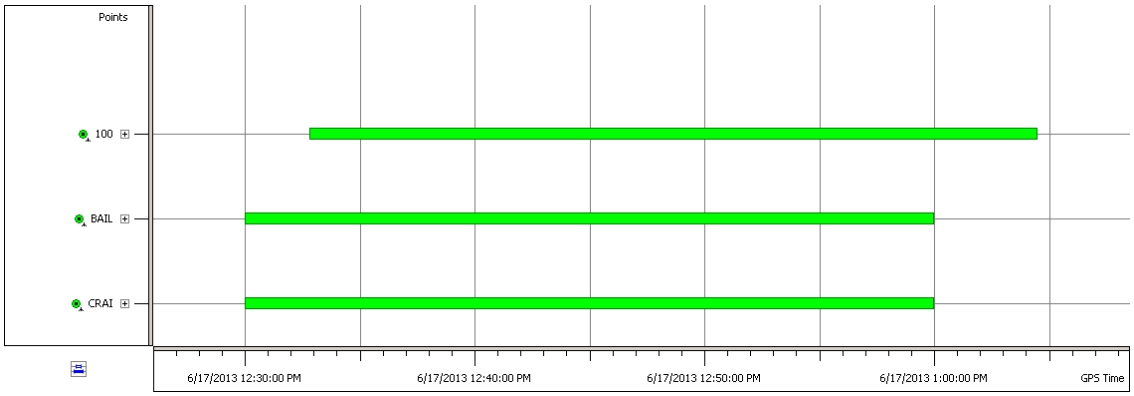

Figure 3 - Stationary time at point 100

Starting from point 100 with known coordinates, with visa on point T109, the supported traverse route 100-200-300-400-500-292 was executed. To determine the new points, each station of the network was stationed and observations were made to the points downstream and upstream of the traverse using the total station Trimble 3300. At the end point of the traverse (292) has completed visa for points 291 and 600, also points with known coordinates.

From the new station points, the detail points were raised using the radiation method. The points of detail were targeted, the angle of inclination, the distance and the orientation were read.

The GPS coordinates of point 100 determined by post-processing using the Topcon Tools application using data from the RINEX file provided by ROMPOS were 44°19'14.91937N and 23° 46'49.89451E, determined with an accuracy of 0.034m at latitude and 0.027m at longitude. These coordinates in the WGS84 reference system were transformed using the Transdat 4.04 program into Stereo70 coordinates: X = 314182,444m and Y = 402844,729m.

The calculation operations for the traverse points were performed based on the data collected from the field (distances, horizontal and vertical angles) entered and processed with the TopoSys program, finally obtaining the absolute rectangular coordinates of the points that delimits the property, in the stereographic 1970 projection system.

The calculated non-closing error on orientations was -0,0008^g and the value of the correction applied to the provisional orientations was + 0.0001^g. The non-closing errors on coordinates were -0.069 m on X and -0.032m on Y, so a total error of 0.076m. The total length of the hike was 187,863m so the tolerance is 0.079m.

The values of the unit corrections were: kx = 3.67 cm / 100m and ky = 1.7 cm / 100m. The provisional coordinates of the waypoints were corrected to obtain the absolute coordinates, presented in Table 1.

Table 1

Coordinate inventory

Point no.	**x**	**y**	**Point no.**	**Obs.**
	m	**m**		
Old points				
1100	314508,940	402572,280	1100	T 104 - C.A. Brestei
Station points				
100	314182,44	402844,73	100	GPS determined point
200	314184,03	402862,19	200	
291	314307,82	402786,14	291	Old point

Point no.	x	y	Point no.	Obs.
	m	m		
292	314238,08	402980,07	292	Old point
300	314214,88	402888,53	300	
400	314240,09	402895,97	400	
500	314260,64	402901,03	500	
600	314214,07	403020,51	600	GPS determined point

Table 2

The coordinates of the contour points and the surface 1Cc

Point no.	X (m)	Y (m)	Point no.	X (m)	Y (m)
830	314261,832	402885,338	9	314166,236	402851,195
820	314256,638	402897,586	112	314174,067	402848,288
90	314255,740	402899,250	6	314182,576	402844,117
89	314255,340	402899,930	5	314191,860	402848,985
85	314255,100	402900,320	4	314202,015	402854,337
86	314254,022	402902,929	113	314203,614	402855,164
110	314252,813	402905,852	1	314196,374	402870,203
87	314251,550	402908,580	114	314218,974	402881,084
69	314250,680	402908,110	52	314222,261	402882,693
70	314243,966	402904,431	115	314224,834	402884,262
71	314232,294	402898,056	54	314227,700	402886,009
72	314223,060	402893,070	116	314234,458	402889,597
111	314218,340	402890,808	117	314235,841	402890,380
35	314216,576	402889,956	55	314237,268	402891,045
17	314205,750	402884,620	56	314238,833	402888,265
16	314194,712	402879,045	57	314242,242	402890,038
15	314176,263	402869,795	118	314245,851	402884,103
13	314154,860	402859,630	59	314248,934	402878,811
12	314151,465	402858,003	119	314254,716	402881,732
10	314158,425	402855,042	830	314261,832	402885,338
Surface 1Cc S = 1735sq m					

Table 3

The coordinates of the contour points and the construction surface C1 (house) and C2 (annex)

C1 – House			**C2 – Annex**		
Point no.	X (m)	Y (m)	Point no.	X (m)	Y (m)
830	314261,832	402885,338	52	314222,261	402882,693
820	314256,638	402897,586	32	314219,392	402888,631
800	314251,600	402895,360	33	314216,120	402887,050
64	314250,940	402897,000	114	314218,974	402881,084
63	314248,220	402895,770	52	314222,261	402882,693
62	314248,870	402894,220	**Surface C2 S = 24 sqm**		
61	314244,650	402892,350			
60	314249,360	402881,900			
122	314253,672	402883,986			
119	314254,716	402881,732			
830	314261,832	402885,338			
Surface C1 S = 170 sqm					

The calculation of the areas was done using the coordinates of the detail points (analytical method) with the help of excel spreadsheets (tables 2, 3).

The reporting operations were materialized through the location and delimitation plan and consisted in the representation of the points delimiting the surface, on A3 format paper at a scale of 1: 500 in the Stereographic 1970 projection system, using Autocad.

Construction surveys were also made with AutoCad based on the sketch and field measurements.

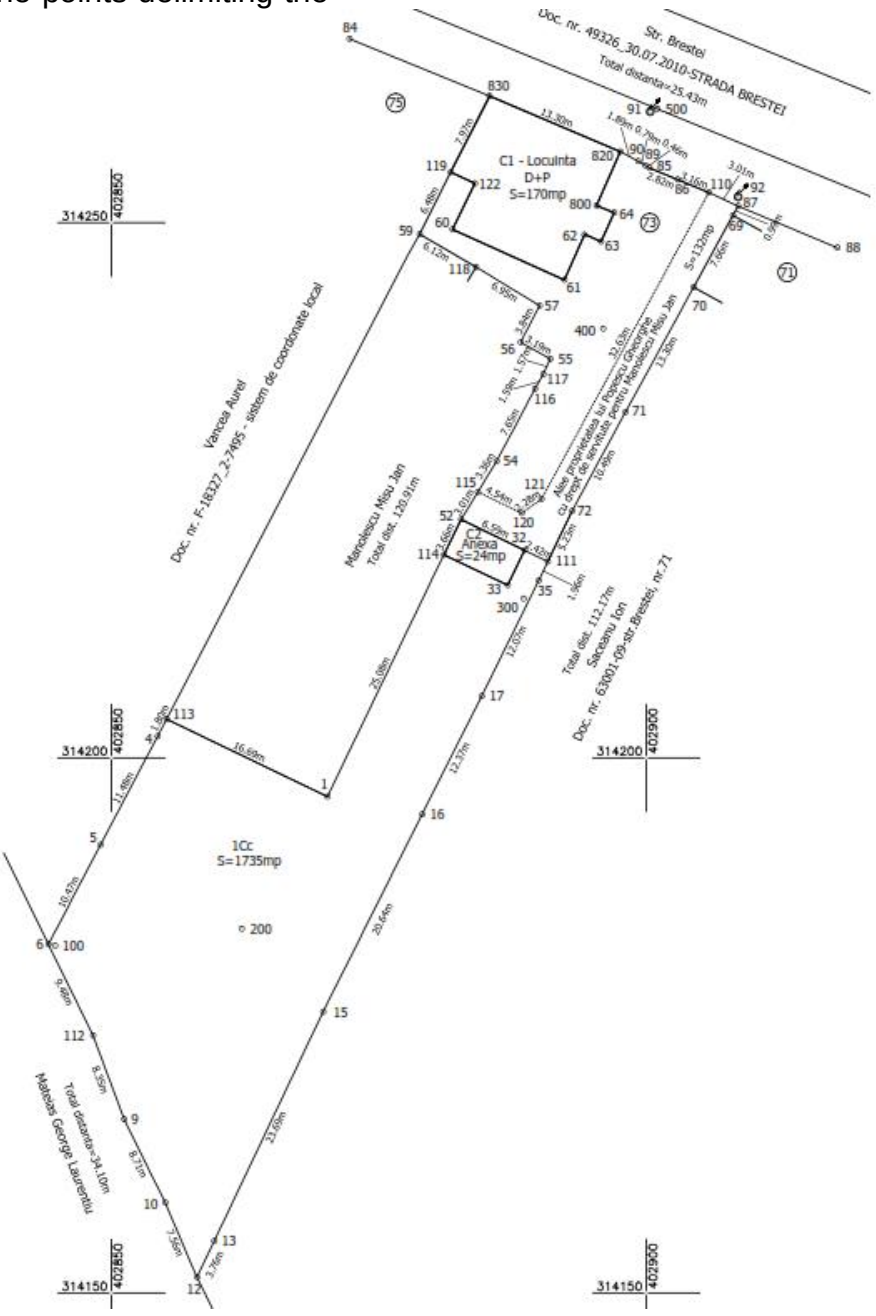

Figure 4. Location and delimitation plan of the building

CONCLUSIONS

The study of the terrain must be done carefully to choose the appropriate methods of surveying.

GNSS technology is easy to use, shortening the duration of field operations and in combination with the total station facilitates the work of the surveyor;

The use of programs such as TopoSys, AutoCAD, and the like is an indispensable tool in modern topo-cadastral activity, helps to streamline the activity and reduces the possibility of calculation errors.

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